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ABSTRACT

In 1965 the Court of Appeals of Kentucky ruled that all property should be assessed at 100 percent of fair market value. In compliance with the court decision, the county assessors began reassessing properties in January 1966. A great controversy arose over the new assessment procedures and problems. This study evaluates the results of the 1966 reassessments and develops a way by which the assessment procedures might be improved. The study first determines the effect of the 100 percent assessment in one area of Kentucky, giving particular emphasis to how well it improves the degree of equity among property assessments. It then describes the development and testing of a method that improves the 100 percent assessment procedures through the use of a regression model involving computer data processing. (Author/DN)

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Property Assessment by Machine

A case study of the application of data processing to real estate assessments in a Kentucky County

by

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FOREWORD

Recent court decisions on public school financing (Serrano, Rodriguez and others) have refocused interest on the property tax and the many problems inherent in its use as a major source of public school revenues. Although the Supreme Court of the United States did not uphold the Federal District Court's decision in the Rodriguez Case, the interest generated by the court tests and the issues raised will have an important reform influence on public school financing for years to come.

Despite the possibility of significant changes in financing plans, however, it seems safe to assume that the property tax will continue for the foreseeable future to be a major source of public school revenues. School administrators will continue to have a vital interest in the best possible administration of this tax.

One of the major problems in the administration of the property tax is that of assessment. Assessment is difficult at any time, but it is particularly so in periods of inflation when the need for additional revenues becomes most pressing. Add to the problem of assessment in a period of inflation the difficulty of changing from partial to full assessment and some understanding of the problems facing Kentucky tax assessors in recent years can be gained.

In such a difficult situation it is particularly pleasing to discover an approach which shows promise of providing a solution. It is to the exploration of such an approach that this *Bureau of School Service Bulletin* is directed. The authors have developed and illustrated a feasible alternative approach to the assessment of urban residential property. The promise of the approach is such that it deserves study by every school administrator who is concerned by inadequacies in present property assessment practices. It is a pleasure to commend the publication.

JAMES B. KINCHELOE
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INTRODUCTION

In 1965, the Court of Appeals of Kentucky handed down the decision, in the case of Russman vs. Luckett, that Section 172 of the Constitution should be upheld. This section stated that all property should be assessed at 100 percent of fair market value. In compliance with the court decision, the county assessors began reassessing properties in both the rural and urban areas in January, 1966. As a result, a great controversy arose throughout the State regarding the 100 percent assessment procedures and problems. The study reported here was an attempt to evaluate the results of the 1966 reassessments and to develop a way by which the 100 percent assessment procedures might be improved.

The first step in this study was to determine the effects of the 100 percent assessment in urban residential areas in Fayette County, Kentucky, with particular emphasis on the matter of equity of the assessments. Specifically, the study analyzed the inequities in assessments under the pre-1966 fractional and the post-1965 full-value systems. Since a primary goal of the 100-percent assessment was to improve the degree of equity among property assessments, its effectiveness in doing so was appraised. Then a method of maintaining and continually improving the 100-percent assessment procedures was developed and tested, using a "regression model" involving computer data processing.

First, the questions to be answered were: Did the revaluation make improvements in the degree of inequities existing among property assessments of residential properties in Fayette County? If improvements were made, what were they? Then the question became: Could further improvements be made? To obtain answers to these questions the researchers tested the following hypotheses:

a) *Properties of different ages.*—Older property had not been assessed as closely to full value as had the new properties. The 100 percent assessment should have rectified this inequity by causing all properties to be reassessed at sale price. The hypothesis, stated in the "null" for purposes of testing, was that inequities between assessments of older and newer properties had not been improved by the new assessment.

b) *Properties in different subdivisions.*—It was felt that there was greater variation in the assessment of the high-valued property than in the low-valued property. The hypothesis was that after the full-value assessment substantial inequities remained within and between both the low- and high-valued properties.

The Method Used in the Revaluation

Because of the capacity to produce revenues, property taxes have survived nearly a century of hostile criticism. Probably one of the most criticized aspects of property taxation is the assessment procedure. Kentucky has been no exception. Although the state constitution specifically calls for full-value assessment of property for taxation purposes, the practice until 1966 was fractional assessment. With the 100-percent assessment now to be enforced, it is important to determine what its effects have been. The best means of making the reassessment to attain greater equality would have been to assess each piece of property individually. Because of the enormity of such a task and the existing administrative system, this was impossible. Instead, various methods were employed, the most common being the multiplier method. By this method, a value was established for a representative property in a given property class or district. The existing assessment was compared to this property value. A multiplier was figured which would raise the assessment to 100 percent of the market value. For example, if an existing piece of property was assessed at 25 percent of its full value, then a multiplier of four would be established. This multiplier was then used to increase the property assessments of all the properties in that area. By such a method little is done to improve the degree of equity between individual property assessments within the multiplier area; between areas, however, aggregate inequalities may conceivably be improved by using different multipliers to bring the assessments together.

An Alternative Proposal

The shortcomings of the methods currently used appear sufficiently important to justify the effort to develop an alternative method for mass appraising which might yield more accurate individual assessments. Basically, the "regression model" developed in this study grew out of the observation that market values depend on the various characteristics of a given residential property. The model was developed from sales data taken from a given period, those data used to predict the sale values in a subsequent time period. The model was tested by comparison of the predicted values of a piece of residential property to its actual sale price. With such a model, the characteristics of a piece of residential property (which are already on file at the assessor's office) could be fed into a computer and assessments rapidly computed. The model could easily be updated each year from sales data from the previous year. Information on individual pieces of property could be currently maintained and updated by the assessor. Thus, such a method of mass appraisal would not require a drastic change-over in the current practices now being performed in the assessor's office and would remove many of the existing doubts concerning the validity of the current assessing process.

PROPERTY TAXATION IN PERSPECTIVE

Property Taxes as a Source of Revenue for Kentucky State and Local Government

Property Taxes play an important role in financing local government in Kentucky and a lesser role at the state level. State and local governments collected 164.7 million dollars in property taxes in 1966 which amounted to 26.8 percent of the total state and local taxes.

During this year, Kentucky local governments obtained about 79 percent of their tax revenue from property taxes.[1] School districts, county governments, and townships received virtually all their tax revenue and three-fourths or more of all locally raised funds from the property tax. At the state level, property taxes play a minor role. For instance, they contributed only 5.2 percent of the total state revenue in 1967. Although property taxes in Kentucky represent only a small fraction of total state revenue, it is a larger percentage of state revenue than in nearby states and is greater than the average for all states of 3.3 percent.[2]

On a percapita basis for total property taxes, however, Kentuckians paid $51.78 in 1966 while the national average was $125.96, giving Kentucky the 46th place among the fifty states in total property taxes paid per capita both local and state. This was 2.5 percent of personal income. The national average was 4.6 percent in 1966 with Kentucky again placing 46th among the fifty states.[3] In making these state comparisons, particularly in comparing the role of property taxes at the local and state level, it should be noted that the division of responsibilities between state and local governments varies widely. In Kentucky, local government provides education, police, fire protection, and other services. These are financed largely from property tax collections.[4] Unless other sources of income can be developed, property taxes will remain an important source for local financing in years to come. This is particularly true in face of the rising demand for public services and the consequent increasing demand for funds to finance these services, including schools.

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[1] U. S. Bureau of the Census, Census of Governments 1967, Assessed Values and Sales Prices of Transferred Real Property, p. 35.

[2] *Annual Report of the Kentucky Department of Revenue 1967-68*, p. 8.

[3] U. S. Bureau of the Census, *loc. cit.*

[4] Tax Research Center of Western Kentucky University, *Research Report. No. 44—State and Local Taxes*, Prepared for the Legislative Research Commission, 1967, p. 1.

Justification of the Property Tax from the Theoretical and Applied Approaches

The property tax has long passed the basic criterion of acceptability by the taxpayers. The other important criterion used to judge a tax is its fairness. The two most commonly used criteria in judging the fairness of a tax are the ability to pay and the benefits received.[5]

The ability-to-pay principle means that persons with equal abilities to pay should be taxed equally and that persons with greater ability to pay should be taxed more heavily than persons with less ability to pay. The property tax has received its greatest criticism because of this criterion. Ability to pay is determined on the basis of income and/or wealth. Property taxes assume a person's ability to pay is indicated by the value of his property holdings (or his gross wealth). This is definitely a questionable assumption. Many properties produce no current income; i.e., mineral lands, idle commercial lots, forest lands, etc. Owners of such properties may not currently be able to pay their share of the tax burden.

Gross wealth can take other forms than merely tangible properties. Human wealth in the form of education and training is completely omitted from the property tax. Persons with large investments in human capital but small investments in tangible wealth may be more able to pay than those with larger investments in tangible properties. Only the income tax tends to offset this inequity in the total tax system.

Present property taxes in Kentucky are considered by many to be inequitable because they tax assets at different rates. Real properties are taxed at a higher rate than intangibles such as stocks and bonds. This is clearly in opposition to the ability-to-pay principle. Ease of concealment and transferability of intangibles further complicates the matter. Inequities in the distribution of the tax burden also exist because of the difficulty of administering the tax. These difficulties are partly inherent in a tax arising out of the use of a base which does not involve a market transaction and therefore requires administrative discovery of the taxable items and establishment of value figures.[6] When there is variation in the range of the ratios of assessed values of property to actual sale values, then the assessments are not equitable and consequently the tax burden is not equitable. However, if the assessments are fairly accurate the correlation between the ability to pay and the tax burden is reasonably high.

Finally, the ability-to-pay concept is weakened because the tax is based on gross value rather than actual net worth. A person with his home fully paid for definitely possesses greater wealth than a person with a similar

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[5] John H. Keith, *Property Tax Assessment Practices*, (Monterey Park, California: Highland Publishing Co., 1963), pp.34-35.

[6] John F. Due, *Government Finance: An Economic Analysis*, (Homewood: Irwin Publishing Co.).

home with a large mortgage on it. Thus, in judging the property tax on the ability-to-pay principle one would have to conclude that, because of the many inequities existing, the tax does not conform to the ability-to-pay criterion.

When judged on the basis of the benefit principle, the property tax has a stronger acceptance. The benefit principle means that those being taxed receive benefits in relation to their tax payments. Since the property tax is collected locally and largely spent locally, then it adheres to the benefit principle. Such functions as police and fire protection are of benefit to property owners, and the benefits derived are proportional to the value of property owned. On an individual basis, however, the benefit principle is not closely followed. Because of the inequities in assessments and inequities of tax rates on different types of properties, certain individuals receiving equal benefits pay different tax amounts. Also, many of the benefits supported by property taxes, such as education, are not directly proportional to the value of property owned.

Another specific theoretical standard of judgment of the taxes, in addition to the above two general criteria, is the effects of the property taxes on land usage. Property tax theorists commonly assert the ability of property taxes, if correctly applied, to cause land to be put to its most productive use and prevent speculative holding of idle land.[7] Property taxation in Kentucky, as in most other states, has definitely failed to prevent speculative holding of its properties. In fact, property taxes, as presently applied, discriminate against improvements on the property, for improvements increase the owner's tax burden. Furthermore, property taxes discriminate against housing because residences are assessed at a greater fraction of full value than are commercial and industrial properties. Property taxes also work against the central city; for high property taxes encourage migration to the outskirts where taxes are lower.[8]

In view of these facts, one must conclude that, although property taxes have a theoretical basis, under present conditions at least, their theoretical justification is weak. The existence of the property tax, the oldest tax, is more readily explained and justified by the fact that it is one of the few readily accessible and feasible sources of revenue for local government. Local income, sales, or excise taxes of any magnitude are difficult to enforce adequately. Also, they lead to migration of population and business activity outside the taxing jurisdiction. Real property is more immobile while incomes, sales, and business are mobile. Only in large cities have efforts of local governments to develop other taxes been fruitful.[8]

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[7] Ray Wenzlick, "The Fundamental Differences Between Real Estate and Other Commodities," *The Real Estate Analyst*, XXXIV (March 19, 1965), p. 77.

[8] With the merger of Fayette County and Lexington City governments, this difference may be reduced.

[8] James A. Maxwell, *Financing State and Local Governments*, (Washington, D.C.: The Brookings Institution, 1965), p. 128.

Trends in Property Taxation

Nationally, there is an evident downward trend in the role of property taxation as a source of local revenue. However, since World War II, property taxes, though declining slightly in their proportion of all taxes (from 46 to 44 percent of the total), remained the largest source of tax funds. In an absolute sense they have increased substantially in the years from 1948 to 1965.[9] The resurgence of the tax, after a long decline, was one of the most surprising developments in state and local finance in the post-war period. By 1975, property taxes are expected to increase by 38.4 percent to $37,753 million.[10] So long as local governments exist as independent, self-governing, administrative, and spending bodies, they must have sources of revenue. Property taxes will continue to provide much of this revenue. No doubt a stronger theoretical argument could be made for the property tax if improvements could be made in its administration. A primary administrative improvement would be to develop an assessment procedure to reduce the inequities in the assessment—an intent in this study.

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[9] The Tax Foundation, *Fiscal Outlook for State and Local Governments to 1975*, A Report Prepared by the Tax Foundation, Inc., (New York: The Tax Foundation, 1960), p. 30.

[10] *Ibid.*, p. 65.

REAL PROPERTY ASSESSMENT PROCEEDINGS IN KENTUCKY

A History of Property Taxation and Assessment in Kentucky

The present system of property assessment is based on the Kentucky State Constitution which was ratified in 1891. Section 172 titled, "Property to be Assessed at Fair Cash Value, Punishment of Assessor for Willful Error," states:

> All property not exempted from taxation by this constitution, shall be assessed for taxation at its fair cash value, estimated at the price it would bring at a fair voluntary sale; and any officer or other person authorized to assess value for taxation, who shall commit any willful error in the performance of his duty, shall be deemed guilty of misfeasance, and upon conviction thereof shall forfeit his office, and be otherwise punished as may be provided by law.

This constitutional provision had been ignored over the years. Violation of the law was even condoned by the courts. In 1913, the Court of Appeals upheld the practice of fractional assessment when it ruled that a distillery in Henry County, which was assessed at fair cash value, should have its assessment lowered to the 60 percent rate that prevailed in the county.[1] In a 1938 case in McCracken County, although recognizing the constitutional requirement of equality of taxation and assessment at fair cash value, the court ruled that where there had been persistent fractional assessments all property should be treated alike. In effect the court said the application of fractional assessments would be allowed.[2]

As the years passed, the fraction of assessed values to market values decreased. After the 1930's this trend accelerated as property values rose rapidly while assessments failed to be increased at a compensating rate. By 1963 the state-wide, average assessment-sales ratio had declined to 27 percent.[3] Although the Kentucky Court of Appeals, in *Eminence Distillery Company vs. Henry County*, had set the precedent for uniformity in property assessments, this too had been disregarded. Great inequities existed between individual property assessments. A few attempts were made over the years at equalizing the assessments. A last attempt in 1954 failed both administratively and politically. This attempt became a controversial issue in the next governor's campaign, working to the detriment of those who had supported equalization. After this episode little was done to improve intercounty and interclass equalization. By 1965 assessment ratios

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[1] *Eminence Distillery vs. Henry County*, Kentucky, 200 SW 347.

[2] *McCracken Fiscal Court vs. McFadden*, Kentucky, 122 SW 2D 761.

[3] Tax Research Center of Western Kentucky University, *Research Report No. 44—State and Local Taxes*, Prepared for the Legislative Research Commission, 1967, p. 17.

varied between 10 and 35 percent among the counties. Within counties individual assessments ranged from almost zero to 50 percent and higher.[4] The coefficient of variation around the mean assessment ratio (a measure of the variability and consequently the inequities of the assessment) in 1965 was a relatively high 31.1 percent.[5]

The continued deterioration of assessment levels and the growing intra-class, interclass, and intercounty inequalities placed increasing pressure on local revenues because of constitutional and statutory rate limitations. At the same time the assessment ratios were declining, the cost of local government, particularly schools, was rising. The increased revenue from new property added to the tax rolls was not sufficient to meet the increased needs. Such a dilemma could only mean some kind of a change was in order.

The needed change was brought about when a group of parents and taxpayers filed suit to test fractional assessments in Kentucky. The reasons for their action were the pressing need for additional public revenues at the local level and the inequities of the present system. The arguments given for a full-value assessment were:

1. The fractional assessment practice is in direct contradiction to the law.
2. Fractional valuation, when the tax rates are at their legal limit, places assessment officials in a position to assume the tax and budget responsibilities of local legislative bodies.
3. The fraction assessments cut the effective tax rates which local governments could impose to a fraction of the rate specified in the constitution.
4. The fractional system resulted in inequities in assessments and consequently the tax burden.

The result of this action on the part of the private citizens was the court decision in the case of *Russman vs. Lucket* which upheld Section 172 of the Constitution. As a result, all property in Kentucky had to be reassessed to 100 percent of its full-market value. Fractional assessments were to be adjusted to their full-market value by January 1, 1966. The county tax commissioners found themselves faced with the seemingly impossible task of revaluing all the individual properties in their jurisdictions in less than six months.

Fractional vs. Full-Value Assessments

The revaluation was performed, but before investigating the details of the revaluation process, let us examine the question of fractional versus

[4] *Ibid.*, p. 18.

[5] J. E. Luckett, "The Administrator's Response to Full Value Assessment," *Proceedings of the National Tax Association of 1966 at Denver, Colorado*, ed. S. J. Bowers, (Columbus, Ohio: 1967), p. 193.

full-value assessments more closely. Fractional valuation is the practice followed in almost all the states and, as had been indicated, was for a long time the practice in Kentucky. Arguments both pro and con can be made for a movement to full-value assessments. Theoretically, however, 100 percent assessment is not necessary in order to obtain equity in assessments. If all properties were assessed at 30 percent of their fair cash values then equity would be attained and the theoretical concepts of an equitable property tax would apply. Basically, both methods entail a determination of the value of a property that is equivalent to the value that the market place would put on the property. In arguing against a full-value assessment, critics point out that, at the present, land prices are higher than the land is actually worth; consequently property tax assessments should not be geared to these inflated prices but to the "normal" value of the property.[6] These persons also say that raising the property assessments aggravates the actual inequalities in assessments which already exist; however, they recognize that there will be no percentage change in the amounts of the inequities that existed.

A must stronger argument can be made for full valuation. Although theoretically the full-value assessment is not necessary to attain equity in assessments, in practice such is not the case. Studies have shown that an inverse relationship exists between median assessment-sales ratios and the degree of inequities in the assessments (Table I). The coefficient of intra-area dispersion, a measure of the inequity of assessments within a given area, increases as the median assessment sales ratio declines. Thus, the

TABLE I

COEFFICIENT OF INTRA-AREA DISPERSION IN RELATION TO MEDIAN ASSESSMENT RATIOS FOR NONFARM HOUSES, SELECTED AREAS, 1956-1961

Median Assessment Ratio	Coefficient of Intra-Area Dispersion*	
	1956	1961
Under 20	37.9	32.7
20.0-29.9	32.0	26.8
30.0-39.9	25.1	23.3
40.0 or more	22.2	19.4

Source: James A. Maxwell, *Financing State and Local Government,* 1961, p. 141.

* Coefficient of Intra-Area Dispersion is a measure of the inequity of assessments within a given area. The higher the figure the greater the inequities in assessments. Figures were found for a particular area by obtaining the average deviation from the mean assessment ratio of the area and dividing it by the mean assessment ratio for the area.

[6] *Ibid.*, p. 195.

amount of inequities in assessments increases as one moves to areas which have lower average assessment-sales ratios. Furthermore, the assessment process cannot be separated from tax policy matters and the accompanying administrative and political implications. Full-value assessments are more conducive to efficient and proper administration of property taxation. The case of Kentucky's experience with fractional assessments is a good example of this point.

Inequities in the Assessments Prior to the Revaluation

Over the years there has been considerable variation in the assessment-sales ratio. From the 1930's until 1966 the ratio steadily declined as the disparities between assessed valuations and actual values increased. The full-value law was disregarded and no official standards replaced it. The state revenue department provided general guidelines and the county commissioners then established their own policies. Under such a system disparities occurred between districts which were under the jurisdiction of different assessors because of differences in interpretation and administration of the rules laid down by the chief assessing officer. Also the state government distributed some grants in aid and other funds on the basis of assessment values per capita. Thus, areas were encouraged to have low assessments in order to obtain state funds.

Furthermore, because local tax and debt limits are tied to assessed valuations, deep under-assessment radically constricted the fiscal powers of local governments. In consequence, assessment officials were placed in a position to assume the tax and budget policy responsibilities of local legislative bodies as taxes and debts were pushed to their legal limits. The tax commissioners, as elected officials, also found themselves pressured to refrain from assessment increases because of the adverse effects such action would create in the next election. In the absence of a clear legal standard there was a strong incentive for each property owner to attempt to beat down his assessment in order to obtain preferential tax treatment. Such pressures were heightened by rising taxes and public resentment of these increases. Fractional assessment only enhanced the temptation to decrease the fractional assessments or at least to prevent any increases in the assessments, resulting in a decrease in the fractional assessment.

As is obvious there was great uncertainty about the proper assessment. The lack of clear standards and the historical variations in the assessment-sales ratios further confused the matter. This confusion created even more problems. Neither the assessor nor the taxpayer was dealing with a figure which was genuinely meaningful. The status of an assessment was not always clear to the assessor and the individual. For example, assuming a $20,000 house assessed at $15,000 under a prevailing ratio of 50 percent was over-valued, the owner would not realize this. Assessors accustomed to fractional valuations usually have difficulty in recognizing that more

valuable properties are really that much more valuable.[7] A $15,000 property might have been valued at $5,000 while a $45,000 property was valued at only $10,000, a 100 percent difference in assessment but a 300 percent difference in value. When current market value is the standard, gross inequities are more noticeable. Almost any property owner can tell the difference between 8 percent and 100 percent, but he finds it difficult to distinguish between 20 and 25 percent or between 8 and 10 percent—yet the relationships are the same, differing only in absolute size.[8] In view of these circumstances, one would have to conclude that the ruling to move to a full-value assessing system was justified. The question that arises now is whether or not the 100-percent assessment accomplished its proported objectives.

The 100 Percent Assessment

The revaluation of 1966 met the provisions of the *Russman vs. Luckett* ruling and the original provisions of the Constitution. No longer was the assessment procedure in contradiction to the law. The 100 percent assessment greatly enlarged the tax base and, althougn House Bill 1 reduced the tax rates, the limitations of the small tax base no longer existed. The tax and budget responsibilities of local government were removed from the influence of the tax commissioner and placed back in the hands of the constitutional authorities. Much of the confusion concerning the proper assessment of a property was dispelled with the enactment of an unequivocal 100-percent assessment. The pressure brought to bear on the commissioners by the taxpaying property owners was reduced with this clear pronouncement of the lawfully correct assessment level. All of these improvements were a direct result of the passage and enforcement of full-value assessments. The other important objective of the full value assessment, a decrease in the existing inequities, was dependent on the procedure used in making the revaluation.

Theoretically, almost complete equalization is possible if all properties are individually reassessed. The only inequities that could result would be instances where the assessments, due to human error, were not close approximations of the market price. This approach, of course, is the optimal approach. Under the circumstances, however, such an approach was impossible because of the large amount of manpower and long period needed for completion. With limited manpower and with less than six months of time, the department had to revalue all the property in Kentucky. Generally, a modified comparative sales-multiplier method was chosen. A single multiplier derived from the mean assessment-sales ratio could not

[7] Ernest H. Johnson, "Fractional Ratios and Their Effects on Achievement of Uniform Assessment," *Assessor's News Letter*, XXXIII, No. 6, (June, 1967), p. 103.

[8] Luckett, *op. cit.*, p. 196.

be chosen because of the great disparity of ratios for various properties. Each tax commissioner broke his district into small specific areas. From these areas representative sales were taken as samples and the mean assessment-sales ratio was computed. When this mean ratio was divided into one hundred, a figure was obtained which was used to multipy all the other assessments in the area to obtain their full-value assessments.

There were some basic faults with this multiplier system. The multiplier was developed from the neighborhood average, consequently the higher-valued houses in the neighborhood were under-assessed while the lower valued houses were over-assessed as the result of the multiplier. The multiplier must have an equitable base to start from if an equitable assessment is to be obtained. Varying the multiplier in different areas and for different types of property can help eliminate some of the original inequities between property types and properties within different locations, but it cannot remove the inequities between individual pieces of properties within these areas or types. This is where the assessor has many complaints when the property owner argues that "his assessment is higher than his neighbor's assessment although they both have almost exactly the same house."

Despite these inadequacies substantial improvements were made in the equity of the assessments throughout the state. The median area index of the coefficient of variation went from 31.1 to 18.9 for residential property for all Kentucky counties.[9] Authorities of sales-ratio studies feel that a coefficient of dispersion of 20.0 or less is an acceptable standard of uniformity.[10] Therefore, the full-value assessment accomplished the objectives set out for it by its advocates. However, public skepticism remained.

Public Reaction to the Revaluation

Public discontent with the full-value assessment can probably be traced to several sources. As noted above, the full-value assessment caused increased equity of assessments. Thus, in a relative sense, certain property assessments were lowered as other property assessments were raised. Although House Bill 1 limited the actual aggregate tax increase to 10 percent of its 1965 level, a relative change in the level of individual assessments meant that properties previously, relatively under-assessed had to shoulder a larger proportion of the tax bill than in the past. The relatively over-assessed properties experienced a lighter tax load under the full-value assessment. It is not unlikely that much of the criticism of the 100 percent assessment came from those with larger tax bills.

The goal of the full-value assessment is an assessment ratio of 100 percent, but this is an average figure. By definition, an average will have

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[9] *Annual Report of the Kentucky Department of Revenue for 1966-67*, (Frankfort, Kentucky: 1967), p. 29.

[10] James A. Maxwell, *Financing State and Local Governments*, (Washington, D.C.: The Brookings Institute, 1965), p. 138.

certain values above and below the mean value. Unavoidably, certain properties were assessed at more than their full value. As a result of the case of *Fitzpatrick, et. al. vs. Patrick, Clerk of Montgomery County,* tax payers were given the legal basis to have their over-assessed property reduced to 100 percent of its market value. In such cases the complaints were often "vigorous"—but the complaints about under-assessments were few and far between. Nevertheless, suspicions were aroused about the equity of the assessment.

The tax commissioners were also plagued with the problem of ignorance on the part of the public as to the workings of the assessing system and what can and cannot be achieved. The public are sensitive about property taxes and are ready to complain if they feel that any discrepencies exist, especially any which would cause them to pay slightly greater taxes than their neighbor, or slightly more than they think they should. There are many who are convinced, incorrect as they may be, that the property tax system is a complete bureaucratic inefficiency and eagerly look for any proof for their conviction. Often, being eager to verify this conviction, they misconstrue facts or misinterpret data so that the assessing officials feel it is best not to draw any more attention to their efforts than is absolutely necessary.

Public criticism can find a basis in the assessing system itself. As has been pointed out repeatedly up to this point, a coefficient of dispersion of the assessment ratios of 20 percent is considered a good achievement, but even a 20 percent dispersion is somewhat faulty. Due to the fact that it is an average, many of the assessments must deviate by far more than 20 percent. Even with a coefficient of dispersion of 20 percent—a person selling his house and buying another could face quite a change in his assessment and thus in his tax burden. Suppose a person sells a $20,000 home and buys a $30,000 home. If the current assessment ratio is 90 percent with a coefficient of dispersion of 20 percent and his present house is assessed at the lower end of this dispersion, then the house would be assessed at approximately $14,400. A neighbor with the same type house in the same neighborhood could be on the upper end of the dispersion and could have an assessment of $21,600 for his $20,000 home. Thus, a difference of $5,200 could feasibly have occurred for similarly valued properties. This is certainly not equitable, yet it is about as accurate as is practical under the present methods of mass assessments. If the new home had been assessed at the value paid for it, $30,000, the buyer's assessment would have risen $15,600 where $10,000 would have been appropriate. Such situations arouse suspicions in the public mind about what goes on in the tax commissioner's office. Although aggregate figures show substantial improvements in the equity of assessments, large individual inequities still exist.

METHODOLOGY

Location of Study

A close examination of the effects of the revaluation of residential property involves an evaluation of the assessing procedures as applied to a specific area. The area chosen for the study was Lexington, Kentucky, including Fayette County. Lexington is the second-largest city in Kentucky, is approaching becoming a first-class city and is of intermediate size. The Lexington area has a wide range of various types of residential properties. Most other towns would not have such a degree of variation and the wide variation is necessary for an intensive study such as this one. Furthermore, Fayette County in which Lexington is located has the records containing the data needed. It was felt by the researchers that the task of assessing was better performed in the Lexington area than in many other cities.

Types of Property

The specific type of property studied was residential property. Residential property is defined for purpose of the study as a single-family residence, occupied, either owned or rented, within that part of metropolitan Lexington that is inside the boundaries of Fayette County. This does not include residential properties bought by commercial organizations. Residential properties represent the major portion of the work load in the assessing process. In 1966, single-family residential houses in the Lexington metropolitan area numbered 39,536 and were 60.4 percent of the total gross assessed value of all real property in Lexington. Furthermore, single-family residences are a relatively homogeneous group of properties and thus are more likely to be able to be assessed by the alternative appraisal method proposed.

The objective of this part of the study is to analyze inequities in the assessments of particular classes of property under the fractional and the full-value systems and to determine effects of the full-value assessment on the equity of assessments and the assessments ratios. The types of properties in question are properties of different ages, properties in different subdivisions and sections of town, and properties of different values. The period of 1964 and 1965 was chosen to represent a time when assessments were on the fractional basis. The period of 1966 and 1967, the period immediately following the full-value assessment, was chosen to represent a time when assessments were on the full-value basis. A period immediately prior to the full-value assessment and a period immediately subsequent to the revaluation should provide the best data for an analysis of the re-

assessment. A two-year period was chosen in order that enough observations might be obtained for each designated property class.

The property age groups were broken down into three classifications, Pre-World War II, Post-World War II to 1960, and 1960 to the present. These divisions roughly correspond to the three most important surges of building activity in Lexington. They also correspond to changes in the basic type of construction used in residential construction. The value classes were divided according to the sale price of $13,000 or less, $13,000 through $21,000, and more than $21,000. The subdivisions and location were designated by the subdivision blue-print plats on file in the Fayette County court house. The subdivision boundaries on these plats formed the subdivision boundaries for the study. In several cases, in order to obtain enough observations for a particular area, two or more adjacent subdivisions were combined if there were no significant physical boundaries, such as a major highway or geographical boundary, or if there were no substantial differences in the types of properties found in each subdivision.

Since properties should be assessed at 100 percent of their fair-market value according to law, sales data that went into the above categories should be from sales that represented the fair-market value of the property. By the legal definition, the fair-market value is "the price decided on by a willing buyer and a willing seller in an arms-length transaction." In order to obtain only those sales that met this definition certain sales were omitted from the population. Those sales omitted included all:

a. Intrafamily sales—i.e., sales from father to son.
b. Sales where a trade of some sort was involved, such as a house sold for a cash sum and a vacant lot.
c. Sales where personal property was included along with the real estate, i.e., a house sold along with its furniture for a total lump sum.
d. Sales involving the government or its administrative agencies, i.e., condemnation sales, sheriff's sales, bankruptcy transfers, etc.
e. Transfers of convenience—i.e., correction deeds, sales of partial interests, etc.
f. Sales involving eleemosynary institutions—i.e., a church's purchase of a residence for a parsonage.

As would be expected the categories of age and value coincided with particular areas or subdivisions. By picking a particular area, one could also be delineating the value and the age of a particular group of properties. The valid property sales for 1964-65 were divided into groups according to location. From these, particular areas were chosen which could provide representations of different age groups, value groups, and locational groups. All other transactions not included in these groups were discarded. From the new population of transactions within the given area, samples were taken of not less than thirty observations. The entire process was then repeated for the 1966-67 period using the same areas chosen in the 1964-65 period. These samples provided the statistical data for analysis.

One may ask if the sales in a particular area actually provide a representative sample of the properties in the area. In residential properties the rate of turn over is relatively high. Of course certain property types were sold more frequently than others, but sales occurred in all the groups used in this study. Stratification of the total population removed the difficulty of obtaining only a few observations of one property type and many observations for another property type in the sample. It was assumed that property transactions, when broken down into type of property, provided more accurate samples from which conclusions could be drawn.

Data Obtained on Each Observation

A certain amount of data were needed on each observation of the samples in order to make the analysis. Both the assessment and the sales value were needed in order to make comparisons. The identity of the buyer and seller and the terms of the transaction were needed for the decision as to whether or not the sale could be considered a valid sale, i.e., met the requirements of a fair market transaction as defined. Because properties of different ages and locations were compared, the age of such property and its address were needed. In cases where improvements had been made on the property, the original construction completion date was maintained as the classifying date. Only in cases where there was a complete basement-to-attic renovation costing a sum approximating the existing value of the unrenovated property was the renovation date chosen as the classifying date for the property. Finally, the date of the transaction was needed in order for the researchers to know whether the transaction should be included in the 1964-65 period or the 1966-67 period.

Areas Chosen for the Study

General Characteristics of I-A Areas

The areas in this grouping were located near the downtown business district. The properties were older, almost all of them having been constructed before 1920 and many before 1900. These sections were surrounded by commercial land-use areas and were transversed by commercial locations which were the result of the uncontrolled mixing of residential and non-residential uses in the early city development as well as of spot conversion from residential to non-residential uses in later years. In these areas were the greatest concentrations of multi-unit dwelling structures in Fayette County. The residential areas in these sections were dominated by single-family units, which made up nearly one-half of all residences in the area, and utilized nearly three-fourths of the land within the area devoted to residential use. The units were closely spaced. Although the single-family units in this general area constituted about one-fourth of all single-family units in Fayette County, they consumed only one-twelfth of all single-family

residential land in the county.[1] Thus, crowding of residences existed in these areas. The recommended standards for residential density state that five single-family residences per net acre (land excluding streets, schools, parks, and other non-residential structures) is the desirable density with seven per acre the maximum.[2] These I-A areas had a residential density of 8.8 single-family dwelling units per net acre. Such crowding also existed in the multi-family residential units in the area, particularly the two- and four-family units.[3] The structural conditions of single unit residences in the I-A areas could be classified as poor by current standards.[4]

The population density of I-A areas was high, being 5,000 or more (often 9,000 or more) per square mile. The percent of non-white population varied widely, from all-white areas to all-non-white areas. The percent of the population fourteen years old and over who were married varied from less than 55 percent to more than 75 percent with most of the areas in the 55 to 65-percent group. The people were of lower educational level with the majority having less than a high school education. The family income was less than $5,000 per year.

Area I-A-1

The I-A-1 area (West High Street Area) was bounded by the L & N Railroad tracts on the north and east, by South Broadway on the south, and the Southern Railroad tracks on the west. It was a mixed area, containing both white and non-white, but with white predominating. The population density was high at 5,000 to 8,900 per square mile. The median family income was very low, less than $3,000. The single-family residences were generally in very poor condition with more than 70 percent of streets classified as unsound. Many of the properties were the "weekly rental" type property.

Area I-A-2

The I-A-2 area (Walnut, Deweese, Race St. area) was bounded by Indiana Avenue on the south, Short Street on the west, Broadway on the north, and Loudon Avenue on the east. This areas was a very heavily populated area with 9,000 or more residents per square mile. It had a mixed white and nonwhite population, with most of it non-white. The median income was low, under $5,000, with one section having a median income falling below $3,000. In general, however, the median income was not as low as in the I-A-1 area. Again, the residential houses in the area could at best be described as poor to fair with significant exceptions. On

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[1] City-County Planning Commission of Lexington and Fayette County, Kentucky. *An Analysis of the Population of Lexington and Fayette County, Kentucky*, Research Report No. 1, 1963, p. 25.

[2] Committee on the Hygiene of Housing, American Public Health Association, *Planning the Neighborhood*, Public Administration Service, (Chicago: 1948), p. 39.

[3] City-County Planning Commission, *op. cit.*, p. 35.

[4] *Ibid.*, p. 26.

some streets, over one-half of the houses were classified as unsound. As in the I-A-1 area, many of the single-family residential properties were of the "weekly rental" type.

General Characteristics of II-A areas

These areas were located in the intermediate urban area and were generally representative of the early suburban development of the years between the two world wars. They were characterized by limited mixture of land use and medium density. Single-family units were definitely dominant over the other higher density residential uses, but duplexes and apartment houses were scattered throughout. More than three-fourths of the dwelling units were single-family.

The residential density in these areas was about 4.6 units per net acre.[5] The areas were occasionally interspersed also with commercial properties, particularly along the major thoroughfares that transverse them. Typically the structures located in these areas were in good structural condition, though some unsound structures could be found.

Area II-A-1

The II-A-1 area was bounded by South Limestone on the east, Plaza Drive on the south, the Southern Railroad on the west, and State Street on the north. This area was the typical, older, all-white, suburban neighborhood slowly being encroached upon by commercial uses. The properties in the area were classified as being in good condition with a few exceptions. The population density was fairly high, being at a rate of from 5,000 to 8,999 persons per square mile. The inhabitants were largely small older families, for the fertility ratio (the number of children under five per 1,000 women) was less than four hundred and the population per household less than three. The educational level of the population was relatively high, for the median years of school completed of persons 25 years of age and over was 12 or more.[6] More than 70 percent of the inhabitants were persons employed in white collar occupations. The median family income for the area was $5,000 to $7,000 in 1960.

Area II-A-2

The II-A-2 area was bounded by Lexington Avenue and the University of Kentucky on the north and east, Vine Street and Central Avenue on the west, and Hanover and High Street on the south. The area was very similar to the I-A-1 area except that there was a greater number of poor or unsound structures. On the whole, however, the structures were in good condition. It was an all-white neighborhood. The growing University had influenced much of this area, for a higher percentage of the structures were multi-unit. Many residences took roomers. The population density

[5] *Ibid.*, p. 40.

[6] *U. S. Census of Populations 1960 Census Tracts*, Lexington, Kentucky, PHC(1)-77, Table P-1.

was relatively high with a rate of 5,000 to 8,999 persons per square mile though the average household had fewer than three persons. The median years of school completed was 12 or more. More than 70 percent of the working inhabitants had white-collar occupations. The median income in this area was slightly higher than in the II-A-1 area, being $7,000 or more according to the 1960 census figures.[7]

General Characteristics of I-B Areas

The I-B areas were located in the fringes of the intermediate urban area and in the suburban area. They represented the beginning of the post-war boom and urban sprawl. The housing was of the lower and middle income group and had an average value of less than $15,000 per unit, with most considerably less. These areas were entirely residential, occasionally bordered by commercial districts, particularly shopping areas. Duplexes and apartments were frequently found in the areas. The condition of the properties was described as good. The density of single-family residences ranged from 2.8 to 4.5 units per net acre, showing a great deal more spaciousness than in the I-A areas.

Area I-B-1

The I-B-1 area (Highlands and Oakwood) was located off the Georgetown Road north of the New Circle Road. This area had been developed in the middle and late fifties. New developments had grown up around these areas. The properties were in good condition and single-family residences were by far the predominant property type. Two-family living units were the other significant property type although a mobile home park was in the same general vicinity. The houses had good spacing and good utility availability. The residents were low-middle and middle-income groups. They were family units with one or more children under sixteen.

Area I-B-2

The I-B-2 area (Meadows-Morgan, Heights-Meadow Park) was older than the I-B-1 area, developed largely in the post-World War II years and the early 50's. It was bounded by North Limestone on the north, New Circle Road on the northeast, the L & N Railroad on the south, and Loudon Avenue on the southwest. Again the predominant residential structure found in the area was the single-family residence, although the two-family unit and multi-units could be found. The houses were much more closely spaced than in the I-B-1 area but nowhere was the density of units per acre excessive. The properties were in good condition. The inhabitants of the area were of the low-middle-income group. The median years of school completed of persons 25 years of age and older was 10 to 11.9. Approximately 50 percent of the population was employed in white-collar occupations. The average household population was 3.25 to 3.49, and 65 to 75 percent of the people over fourteen were married.

[7] *Ibid.*, PC(1)-17, Table 76.

General Characteristics of II-B Areas

The II-B areas could be described as being in "suburban" Lexington. Single-family units greatly predominated in these areas. Generally, single-family units constituted 85 percent of all dwelling units and occupied 95 percent of the residential land. Duplexes and apartment complexes were found in these areas, as were suburban shopping centers. One of the study areas, Meadowthorpe, was located on the northern end of town; one, Idle Hour-Johnson Heights, was on the eastern side of Lexington, and the rest were in the south and southwest part of the city. Locational variability was obtained in selection of study areas of this class. The structures in these areas were in very good condition. Spacing was good and no overcrowding existed. The inhabitants of these areas were middle-income groups. There were a great many high-valued properties in some of these areas so that classification of a property into a particular value-range category was tenuous at best. Also, construction was still taking place in some of these areas. The II-B study areas were very similar in type and condition of structures, population characteristics, availability of services, etc. The principal differences between the areas were locational.

Area II-B-1

The II-B-1 area (Meadowthorpe) was bounded by the New Circle Road on the north, the Southern Railroad on the east, and Leestown Pike on the south and west. It was developed largely during the fifties with some construction taking place later. Single-family residential structures predominated, but duplexes existed as well as apartment complexes. The inhabitants were largely of the middle-income group.

Area II-B-2

The II-B-2 area (Idle Hour-Johnson Heights) was located on the eastern side of Lexington; the Idle Hour section was bounded by the Idle Hour Country Club on the west, the Richmond Road on the south, New Circle Road on the east, and the Chesapeake and Ohio Railroad on the north. The adjacent Johnson Heights area was bounded by the C & O Railroad on the south, Henry Clay Boulevard on the west, Strader Road on the north and New Circle Road on the east. A few duplexes and some multi-unit apartments existed along with the single-family residences. The population was largely middle-income families. The median years of school completed was 12 or more. The majority of employed persons were in white-collar occupations.

Area II-B-3

The II-B-3 area (Twin Oaks) was bounded by the Harrodsburg Road and Cardinal Lane on the north, Clays Mill Road on the east, and the New Circle Road on the south. Single-family residences, with a few exceptions, were the property types in the area. The structures were in very good condition. Development of the area took place in the late fifties with some construction having taken place later. The inhabitants were

largely middle-income families. From 50 to 70 percent of the employed persons were in white-collar occupations. The rate of turnover of ownership in this area was above average for Lexington.[8]

Area II-B-4

The II-B-4 area (Gardenside) was more spread out than the three previous II-B study areas. It was bounded by Celia Lane on the north and east, Alexandria Drive and Lane Allen on the west and south, and the Harrodsburg Road on the south. The area property usage was single-family with some two-family units. The structures were in very good condition. The population characteristics were similar to those of II-B-3.

Area II-B-5

The II-B-5 area (Southland) was bounded by Southland and Lane Allen Roads on the north, Clays Mill Road on the west, Stone Road on the south, and the Southern Railroad tracks on the east. This area was a single-family residential area with occasional two-family structures. The structures in general were in very good condition. The population characteristics were similar to those of the previous two groups.

General Characteristics of III-B Areas

The III-B areas were the areas developed largely in the post-World War II years up to 1960 which contained the higher-valued residences. In actuality, the areas contained a mixture of middle- to higher-valued homes, with the higher-valued home predominating. The structural conditions of the residences were very good. More heterogeneity of individual housing structure types were to be found in these areas. Single-family residences greatly predominated, although occasionally spots of two- or multi-family units could be found. The inhabitants were in the middle, upper-middle, and upper-income groups. There was a good deal of similarity among the three research areas in this classification. The Zandale area was more recently developed than the Ashland Park or the Kenwick-Fairwaylands areas, and the rate of owner transfers was somewhat higher. Other differences between the areas were largely locational with III-B-1 being on the south side of Lexington and III-B-2 and III-B-3 being on the east and southeast sides.

Area III-B-1

The III-B-1 area (Zandale) was bounded by the Nicholasville Road on the west, Tahoma Road on the north, Bellefonte Drive on the east, and Lowry Lane on the south. This area was a mixed neighborhood of middle- and high-valued homes tending toward the high-valued. The area was almost entirely single-family residences. The structures were in very good condition. The employed inhabitants were white-collar workers. Median years of school completed for persons 25 years of age and over

[8] City-County Planning Commission, *op. cit.*, p. 45.

was more than 12 years. The average household had from 3.50 to 3.75 members. The median family income was above $9,000. The area also had a higher-than-average turnover of residential sales.

Area III-B-2

The III-B-2 area (Kenwick-Fairwaylands) was bounded by Henry Clay Boulevard on the west, Carolyn Drive on the north, Holiday Road on the east, and the Richmond Road on the south. The residences were largely higher-valued homes. A few double and multi-family units were to be found in the north section of the area. The structures were in very good condition. The population characteristics were similar to those of the III-B-1 area. The rate of sales in this area was not as high as in the Zandale area.

Area III-B-3

The III-B-3 area (Ashland Park-MountVernon-Chevy Chase Area) was bounded by Ashland Avenue on the north, the University experimental farm on the west, Lakewood Drive and Chinoe Road on the south, and Richmond Road on the west. The area immediately around the Chevy Chase Shopping Center was eliminated from the study because the property types were not representative of those under study in the III-B-3 group. Because of the extensiveness of the area, more heterogeneity of residential property types was found in this research area. Although the single-family residence greatly predominated, duplexes and areas of multi-family housing units could be found. The population characteristics were similar to those of the III-B-1 and III-B-2 areas.

General Characteristics of I-C Areas

The I-C areas had been developed largely since 1960. The residential houses were the lower- and middle-valued houses with the low-valued houses predominating. One should realize that even within the low-value range there can be substantial variation in residential values and conditions. The I-C residents were in far better condition than the near-poverty-level houses of parts of the I-A areas. It also can be generally concluded that the I-C areas were in better condition and the average house values were higher than in the I-B areas. The structural conditions in the I-C category could be described as fairly good. Single-family residences predominated in the area. The residents of these areas were the middle- and low-middle-income groups. The two I-C research areas were located in the same part of Lexington, the northeast side. In both areas development was still taking place at significant levels.

Area I-C-1

The I-C-1 area (Thoroughbred Acres) was bounded by I-75 on the west, Highway 353 and Swigert Lane on the north, Kingston on the east, and Paris Road on the south. Single-family residences greatly predominated but two-family units also existed in the area. The structures could be

described as being in good condition. Fifty to 70 percent of the inhabitants were in white-collar occupations. The median years of school completed was over 12 years and the average population per household was 3.5 to 3.75. The fertility ratio (number of children under five years per 1,000 women 14 to 44 years old) was higher than average, being 600 or more. This high ratio indicated that young family groups were in the majority in the area.

Area I-C-2

The I-C-2 area was located between the New Circle Road and I-75. It was bounded on the west by Russell Cave Pike and on the east by Highway 68. The area was very similar to the I-C-1 except that it had been more extensively developed as far as percentage of vacant land remaining for development. The types of residential properties were generally the same as those found in I-C-1. The population characteristics were the same for both I-C-1 and I-C-2.

General Characteristics of II-C Areas

The II-C areas could be adequately described as the new middle-class suburban areas in Lexington. Again single-family residences made up over 80 percent of the dwelling units and occupied 95 percent of the residential land in the II-C areas. A noticeable development in these areas was the increase in the number of multi-family residential structures. Two-family units could also be found scattered throughout the II-C areas. In the II-C areas there was a mixture of lower- middle- and high-valued houses, but the middle-valued houses predominated to a noticeable extent. The inhabitants of these areas were predominantly middle class with a mixture of lower- and upper-middle income groups. The properties were in good condition. In many of the areas construction and development was continuing. The characteristics of the II-C areas in terms of structures and inhabitants were very similar. The primary differences occurred in locational variation. The Cardinal Valley area was located in the western part of Lexington, the Deep Springs-Kenawood area in the northeast part of Lexington, the Brigadoon-Stoneybrook area in southern Lexington, and the Beaumont Park-Garden Springs area in the southwest part of Lexington.

Area II-C-1

The II-C-1 area (Cardinal Valley) was bounded by the Versailles Road on the south, the Southern Railroad on the north, Woodford Drive on the east, and Hillcrest Cemetary and Newcastle Street on the west. Although the large majority of residences were single-family, there were substantial numbers of duplexes and multi-unit residences in this area. The properties were in good condition and neighborhood conditions were very good. The area was fully developed. Only occasional new construction was taking place, but adjacent areas were under development. The residents of the area were middle-income families. The dependency ratio, the number of persons under fifteen years of age and over sixty-four years per one

hundred persons fifteen to sixty-five years of age, was 50 to 59. This ratio was slightly under the average and was less than that of any other II-C area. Likewise, the population per household, 3.25 to 3.49, was less than in the other II-C areas. The median years of school completed was 11.9, which is lower than in the other areas. White-collar workers made up 50 to 69.9 percent of the occupied population of the area. The median family income was $6,000 to $7,000. In general, this area differed the most in population and property characteristics from the other II-C areas.

Area II-C-2

The II-C-2 area (Deep Springs-Kenawood) was located in northeast Lexington. It was bounded by Bryan Station Road on the north, I-75 on the east, Eastland Parkway on the south, and New Circle Road on the west. The area was rather extensive with a greater mixture of housing types and value ranges than the other II-C areas had. Single-family residences composed more than 80 percent of the units, but duplexes were scattered through the area and enclaves of multi-family units were in certain sections. The property and neighborhood conditions were good. Development was still taking place with both single- and multi-family residences being constructed. Since more than 75 percent of the inhabitants over fourteen years old were married, the average household population was 3.75 or more, and the fertility ratio was 600 or more. The population could be described as largely of middle-aged family units. The median years of school completed was over 12 years, and 50 to 69.9 percent of the employed persons were in white-collar jobs. The median family income was $6,000 to $7,000.

Area II-C-3

The II-C-3 area (Brigadoon) was located south of Lexington and was bounded by Nicholasville Road on the west and the New Circle Road on the north. Extensive development was still taking place within this section and in the adjacent areas. The residences were almost entirely single-family units. There was a mixture of middle-, lower- and higher-valued homes. The middle-valued homes greatly outnumbered the others. The characteristics of residents of the area were similar to those of residents of the II-C-2 and II-C-4 areas. The median income, over $7,000, was slightly higher for this area than for the II-C-1 and II-C-2 areas. The biggest difference between this area and the others was in the increased amount of development taking place within and around it.

Area II-C-4

The II-C-4 area (Beaumont Park-Gardensprings) was bordered by the extended by-pass on the south and west, Parker's Mill and Lane Allen Road on the north and northwest, and the Harrodsburg Road on the south and southeast. Single-family residences predominated, but there were also duplexes and substantial multi-residential complexes in the area. There was a good deal of heterogeneity of property value types found in this

area. Properties ranged from the lower-valued to the higher-valued residence, but the majority of the residences were middle-valued. The majority of the inhabitants of this area were found to be in middle-class-family units as found in the other II-C areas.

General Characteristics of III-C Areas

The III-C areas were the upper-middle-income residential areas. These areas were still underdeveloped at various levels. Residential units were almost entirely single-family units with occasional two-family or multi-family units. The residential types in these areas were not limited to the upper-value-range houses. Many middle-value-range homes could be found, but these were in the significant minority. The housing units in this area had more individuality than those in the other research areas. Many of the homes were custom built or had a variety of added accessories not found in the lower-valued homes. Also, lot size and landscaping differed more from house to house.

Area III-C-1

The III-C-1 area (Chevy Chase-Lakewood) included the new section of Chevy Chase from Colony Road, Providence Road, Cochran Road southeast to Mount Tabor Road. This area met the general description of other III-C areas, with residential units being almost entirely single-family structures which were in very good condition. The residents of the area were middle-aged-family units. Over 70 percent of the employed labor force were in white-collar jobs and the median income exceeded $7,000. The median years of school completed was over 12. Families averaged over 3.75 persons and the fertility ratio was over 600.

Area III-C-2

The III-C-2 area (Stonewall) was located in southeast Lexington and bounded by Clays Mill Road on the east, Higbee Road on the south, and Wellington Way on the north. The housing units in this section were single-family structures. Substantial development was continuing in the area. The property types and residents are similar to those in the other III-C areas.

Area III-C-3

The III-C-3 area (Gainesway) was bounded by the extended New Circle on the north, Tates Creek Road on the east, and Armstrong Mill Road on the south. Single-family residences were found in this area. There was a range of middle- to high-valued homes with the higher-valued homes predominating. Development was continuing in the area. The population characteristics were similar to those of the other III-C areas.

Area III-C-4

The III-C-4 area (Lansdowne) was bounded by Albany Road on the north, Tates Creek Road on the west, and the extended New Circle Road on the south. Single-family units comprised the housing structures found

in the area, with the exception of some multi-unit structures. A minority of middle-valued homes were also found in the area. Again, population characteristics were similar to those of other III-C areas.

Coding of the Individual Research Areas

In addition to the groupings set forth in the above delineations of the specific areas to be studied, further groupings of the areas were required. As previously noted, the observations, when stratified according to age, value, location, etc., closely conformed to the stratifications based on subdivision boundaries. For this reason, the groups were arranged for analysis in a tabular form (Table II). Information was obtained according to these classifications for the period 1964-65 and for the period 1966-67. With the sample areas arranged in this manner, the specific areas could be coded. For example, the West High Street Area, which was a low-value-range area of pre-World War II date, was coded I-A-1. The Brigadoon-Stoneybrook-Boralto area, which was a middle-value-range residential area constructed largely since 1960, was coded II-C-3. The areas were used for the 1964-65 assessments and for the 1966-67 assessments. To distinguish between the data for the 1964-65 period and the data for the 1966-67 period, the identifying years were added to the code. For example, data on the West High Area for the 1964-65 period were coded I-A-1 (64-65). The data for the same area but in the 1966-67 period were coded I-A-1 (66-67). In this manner data for each subdivision area in the study were coded.

Data Sources

Several sources provided the data on the individual areas. The Research Branch of the Kentucky Department of Revenue annually takes a large sample (600-1,000 observations) of the property transactions in Fayette County for its research purposes. These transactions are taken only from those transactions that meet the requirements of a fair-market transaction. Thus, much of the original separation of "fair" transactions from other transactions was not necessary. Access to these data for 1964, 1965, 1966, and 1967 was made available. From these records, all the transactions for properties within the research areas were recorded. The remaining transactions which took place in these areas during the designated periods were obtained from the records in the Fayette County Tax Commissioner's office.

The data in the tax commissioner's office were listed according to street address. All the streets in the particular research areas were determined and a street-by-street check of all the transactions that occurred during 1964-67 was made. These transactions were then checked to see if they were fair-market transactions; if not they were discarded. In this manner the population samples of the research areas were obtained. The result was a separation of all the sales occurring in the period of 1964-65, within the research areas, into groups according to the categories illustrated in

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TABLE II

RESEARCH AREAS

Value of Property	Age of Property		
	A Pre-World War II	B Post World War II to 1960	C Since 1960
Under $13,000	I-A I-A-1 West High Street Area I-A-2 Walnut, Deweese, Race	I-B I-B-1 Highlands-Oakwood I-B-2 Meadows-Morgan Heights	I-C I-C-1 Thoroughbred Acres I-C-2 Dreamland
$13,000 to $21,000	II-A II-A-1 Medical Center South II-A-2 West UK to Chevy Chase	II-B II-B-1 Meadowthorpe II-B-2 Idle Hour-Johnson Heights II-B-3 Twin Oaks II-B-4 Gardenside II-B-5 Southland	II-C II-C-1 Cardinal Valley II-C-2 Deep Springs-Kenawood II-C-3 Brigadoon II-C-4 Beaumont Park
Over $21,000		III-B III-B-1 Zandale III-B-2 Kenwick-Fairwaylands III-B-3 Ashland Park-Mount Vernon-Chevy Chase Area	III-C III-C-1 Chevy Chase III-C-2 Stonewall III-C-3 Gainesway III-C-4 Lansdowne

Table II, and a second separation of all the sales occurring in 1966-67 within the research areas into groups. An example of the separations would be two populations for the West High Area I-A-1. The first population contained all the valid sales for the 1964-65 period that occurred in the I-A-1 area. The second population contained all the valid sales for the 1966-67 period that occurred in the I-A-1 area. One should realize that the same piece of property would appear in the two populations only if it was sold in a valid sale in both periods. From the populations, samples containing not less than thirty observations were drawn as described previously. These samples were representative of the sales that occurred in each research area in each period respectively.

The records in Frankfort, in the Fayette County tax commissioner's office, and in the Fayette County Court House provided, in addition to the sales data, the assessment on the property, the buyer and seller, the date of the transaction, and the location for each transaction. Thus, the samples, being representative of their respective areas, furnished the information needed for the comparative assessment-sales ratio analysis. A total of 1564 observations, including sales data, assessed value, buyer and seller, transaction date, age, and location were collected in the samples.

Certain difficulties were encountered in the efforts to obtain this information. The most difficult problem was obtaining the actual market values for properties sold. The data in the files of the Department of Revenue in Frankfort were accurate. The procedure used by Frankfort in obtaining the property values was the following: A letter was sent to both the buyer and seller asking them to state the sale price of the property. When the Department received the replies, and if the price stated by the buyer and seller coincided, the price was recorded in the records. The data on transaction price obtained from the Department of Revenue was considered completely satisfactory for the study.

The sale prices of other transactions were more difficult to obtain. Several sources were relied upon to obtain these data. For most of the residential sales after 1965, after the establishment of the full-value assessment, the sale price was recorded in the records at the Tax Commissioner's office. These figures were used in the analysis. For the period prior to 1966, and for those transactions after 1965, for which there was no recorded sale price in the tax commissioner's records, the sale prices had to be obtained from the deed and mortgage records on file in the Fayette Courthouse. Obtaining the sale price from the deed and mortgage books required a search in the record of deeds. If cash was paid for the house, or a new mortgage placed on the house, Federal revenue stamps were required for the cash transaction. The rate on the stamps was $1.10 per thousand dollars. If a mortgage was assumed in addition to a cash transaction the stamps would only cover the portion of the sale price which was covered by the cash transaction. Sometimes the unpaid balance of the assumed mortgage would be listed in the deed. If this was the case, the sum of the cash transactions, as shown by the revenue stamps, could be

added to the principal outstanding on the mortgage to yield a sum equivalent to the sale price. In most instances, if a mortgage was assumed, the unpaid balance was not recorded. In such instances, the morgage was looked up in the records of mortgages where the principal originally borrowed and the date of the mortgage, the file of the mortgage, the number and terms of payments, and the rate of interest could be found. With this information and with the help of amortization schedules, the unpaid balance of the mortgage remaining at the time of the loan could be computed. This amount was added to the cash transaction amount to yield the sale price of the home.

There were several possible sources of error in using these methods to compute a sale price. Occasionally, an error is made in putting the correct amount of revenue stamps on the deed. This may have been an intentional or an unintentional error, but in either case the stamps do not represent the actual cash transaction. There is no way of determining when such an error occurs, but it is not a frequent occurrence. Also, the revenue stamps are not as precise in indicating the amount of the cash transaction as one might like. Although the stamps are available in denominations as small as $.05, thus allowing precision to within $45.00 of the sale price, they are not always used with such accuracy, and calculations may be slightly off the actual sale price. A third source of error can occur in computing the principal outstanding on an assumed mortgage. Almost all mortgages are paid off on a regular payment schedule; however, there is no rule against making the payments ahead of schedule or making a larger payment than the normal payment. Occasionally this occurs so that the mortgage is reduced ahead of the normal schedule. Again, there is no way of determining from the available data when this occurs. All three cases must be considered possible sources of error in the analysis, but the probability of a significant effect on the results is negligible.

To avoid errors the computed sales prices were checked for apparent reasonableness in light of the property sold. In judging apparent reasonableness of the computed sales price, the type of property and house in question, the location of the property, and the sales values of surrounding and/or similar properties were taken into consideration. If a question about the validity of the computed sales price remained, a professional assessor or realtor was consulted. If any question about the appropriateness of the price remained, the particular observation was discarded because of the likelihood of an error.

Spot checks were made of the accepted sale prices. In many instances the sale price could be obtained from more than one source. For example, the sale price might be obtained from the data at the Department of Revenue in Frankfort and from the records in the tax commissioner's office. Since the valuations at these sources were obtained by different methods, the coincidence of valuation figures from the different sources would indicate satisfactory accuracy in the figures. In all the comparisons made the valuation figures matched.

The Method of Data Treatment for the Analysis

Several methods could be used to compare the data for the 1964-65 period to the 1966-67 period. More than one was employed to analyze the results of the full-value assessment. The reader will remember that the objective of this study was to determine the effects of the full-value assessments on the level and equity of the assessments on residential properties, particularly in the cases of older versus newer houses, houses of different value classes, and houses in different locations and subdivisions.

The data analysis was divided into two sections. The first part dealt with the level of assessment-sales ratios and the second dealt with the equity of the assessment-sales ratios. The first part relied on the use of the assessment-sales ratio figures. An assessment-sales ratio is the assessed value of a property at the time of its sale divided by the actual sale price of the property. The ratio is expressed in percentage terms denoting what percent of the sale price is the assessed value. An assessment-sales ratio analysis aids in determining the equity of the property assessments between groups of properties and the level of assessment among different property types. The assessment-sales ratios of the different property groups in 1964-65 were compared to those of the groups for 1966-67. Thus, an analysis was made of the effects of the revaluation on the assessment-sales ratios of different property types.

Since Kentucky's law stipulates that the assessed value be equal to the full sale price of the property, the assessment-sales ratio should, after the full-value assessment, be 100 percent. In reality, as has been pointed out, the overall assessment sales ratio is an average figure. There is a deviation about this average. Some assessments are greater than the full-market value of the residence and others are less than the average. By law, assessments greater than market value are illegal and may be reduced. Most assessments over 100 percent of the market value have been reduced, resulting in an average assessment-sales ratio of less than 100 percent. The average ratio for residential property in Fayette County in 1966-67 was approximately 92 percent. This fact should be kept in mind in considering the results obtained in this assessment-sales analysis.

In order to compare the assessment sales ratios of the two periods, the ratio for each observation in all the samples had to be computed. Next the mean assessment-sales ratio for each group was computed. This was done for both the 1964-65 period and the 1966-67 period.

Before the ratio comparisons could be made, an important problem had to be solved. Prior to the full-value assessment, the method of determining the goal assessment-sales ratio was very vague. Generally, the accepted method was to use the existing average ratio as a standard in assessing properties. This procedure conformed to the court rulings that equity in assessments was the most important objective of the assessing process.[9] & [10]

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[9] *Eminence Distillery vs. Henry County*, Kentucky, 200 SW 347.

[10] *McCracken Fiscal Court vs. McFadden*, Kentucky, 122 SW 2D 761.

The assessment ratio for residential property in Lexington for the period 1964-65 was 28.8 percent. Thus, for purposes of analysis, it was assumed that this was the goal ratio for this period. In the 1966-67 period the assessment-sales ratio goal was 100 percent; however, because of the effect of reducing all assessments that were greater than 100 percent, the average ratio for single family residential properties was 91.57 percent. Although a direct comparison of the ratios for the two periods is not possible, they can be put on a comparable basis. A multiplier was used to multiply the 1964-65 ratios to a figure comparable with the 1966-67 ratios. This multiplier was calculated by dividing the ratio goal for 1966-67 by the ratio goal for 1964-65:

$$\frac{\text{66-67 Goal}}{\text{64-65 Goal}} = \text{Multiplier}$$

Because of the difference between the legally defined goal of 100 percent of the market value and the procedurally feasible goal of 92 percent, two multipliers were computed for the computations. One multiplier (3.47) was derived using 100 percent as the divisor and the other (3.18) was derived using 92 percent as the divisor.

$$\frac{100\%}{28.8\%} = 3.47 \qquad \frac{92\%}{28.8\%} = 3.18$$

Once the multiplier was derived, the mean assessment-sales ratios for the 64-65 period were multiplied by both multipliers in order to obtain a ratio that would be comparable to the mean assessment ratios for the 66-67 period. By comparing the adjusted ratio before the full-value assessment, one could determine the effects of the full-value assessment on the assessment-sales ratios, and thus, on the equity and level of the assessments.

A shortcoming of the above technique was its inability to provide satisfactory insight into the equity between individual assessments within the research areas. To analyze individual inequities, a coefficient of variation was used. The coefficient of variation is a measure of the amount of variation in the assessment-sales ratios of the individual observations in each sample. This coefficient is calculated by dividing the mean assessment-sales ratio into the average deviation about the mean. The larger the amount of variation between the assessment-sales ratios in a sample, the greater the deviation about the mean ratio for the sample. The larger the average deviation about the mean, the larger the coefficient of variation. Therefore, the larger the coefficient of variation, the less uniform and equitable is the assessment in the research area.

A coefficient of variation was computed for each sample area for both periods. The coefficient of variation for each sample area before the reassessment was compared to the coefficient for the same sample after the assessment. The samples were also grouped according to age. A coefficient of variation was computed for the age groups for both periods and the comparison was again made. The same procedure was carried out for

different value groups. In all comparisons of the coefficients of variation a "T" test was used to determine the level of significance of the differences between the coefficients. By analyzing the data by such methods, conclusions could be drawn about the effects of the full-value assessment on residential properties in Fayette County.

THE ANALYSIS OF THE EFFECTS OF THE FULL-VALUE ASSESSMENT USING THE ASSESSMENT-SALES RATIO APPROACH

Usefulness of the Assessment-Sales Ratio

The assessment-sales ratio is useful for determining the accuracy or level of an assessment. This ratio has particular relevance in Kentucky because of the law establishing the level of assessment of real property at 100 percent of the property's market value. By providing a comparison of the assessed value of a property to its market value, the assessment-sales ratio provides a direct measure of the extent to which each assessment complies with the law. Furthermore, by comparing the mean assessment-sales ratio for the two periods, one should be able to draw conclusions about the effects of the revaluation on the level of assessment of various types of properties. Also, by comparing the level of the assessment-sales ratios between different property types, one should be able to ascertain the degree of equity obtained by the full-value assessment.

A Comparison of the Research Areas' Mean Assessment-Sales Ratio for 1964-65 and 1966-67

In comparing the mean assessment-sales ratio of the 1966-67 period to that of the 1964-65 period, certain considerations should be emphasized. Prior to full-value assessment, the assessment goal was not as widely known or, at least, as clearly established. In fact, the assessor often did not make a concerted attempt to attain a goal. When one multiplied the existing ratios in the 1964-65 period by a multiplier to obtain comparable ratios, he could assume simply that the 1964-65 goal of 28.82 was publicly known and followed, as is the case of the present 100 percent assessment goal. The public did not widely know the local ratio goal, though it did know that historically no goal for assessed valuations was rigidly pursued. Since the accepted goal ratio for the 1966-67 period was approximately 92 percent, the comparisons between the two periods made in this study were based on this ratio for 1966-67 with the ratio for the 1964-65 period multiplied by 3.18 to obtain the adjusted mean ratio (Table III).

There is a great increase in the assessment-sales ratio as one moves from the 1964-65 period to the 1966-67 period. The overall average assessment-sales ratio for single-family residences in the 1964-65 period was 28.8 percent. After the full-value assessment, the assessment-sales ratio for single-family residences in the 1966-67 period was 91.57 percent, an increase of approximately 218 percent.

The first analysis is of the comparison of the mean ratio for a research

TABLE III

1964-65 SALES-ASSESSMENT RATIOS ADJUSTED TO 100 PERCENT ASSESSMENT (Ratio x 3.47) AND ADJUSTED TO THE 1966-67 MEAN ASSESSMENT RATIO OF 91.57 (Ratio x 3.18)

Research Area	Actual 1964-65 Mean Assessment-Sales Ratio	Mean Assessment-Sales Ratio Adjusted to 100 Percent	Mean Assessment-Sales Ratio Adjusted to 91.57	67 Mean Assessment-Sales Ratio Actual 1966-
I-A-1	31.92	110.76	101.51	82.68
I-A-2	23.77	82.48	75.59	97.93
II-A-1	23.70	82.24	75.37	89.54
II-A-2	28.40	98.55	90.31	89.90
I-B-1	27.43	95.18	87.23	94.38
I-B-2	26.15	90.74	83.16	88.92
II-B-2	28.91	100.32	91.93	94.11
II-B-3	30.36	105.35	96.54	90.50
II-B-4	28.22	97.92	89.74	90.24
II-B-5	27.43	95.18	87.23	87.77
III-B-1	29.15	101.15	92.70	89.99
III-B-2	29.92	103.82	95.15	87.75
III-B-3	27.27	94.63	86.72	90.01
I-C-1	27.53	95.53	87.54	95.48
II-C-1	29.78	103.34	94.70	93.95
II-C-2	30.02	104.17	95.46	98.12
II-C-3	30.69	106.49	97.59	93.96
II-C-4	29.84	103.54	94.89	90.17
III-C-1	28.26	98.06	89.87	92.08
III-C-2	30.79	106.84	97.91	86.36
III-C-3	31.35	108.78	99.69	96.54
III-C-4	32.18	111.66	102.33	94.13
Fayette County	28.8	100.00	91.57	91.57

area in the period immediately preceding the full-value assessment to that of the period immediately following (Table IV). The "T" test was used to determine whether there was a significant difference between the means for the two periods. The results varied from the 95 to the 99 percent confidence intervals—indicating a strong *unlikelihood* that the differences could have occurred by chance. At the 99 percent confidence level, in three of the twenty-two research areas (or 13.5 percent of the areas) there was a significant difference between the mean assessment ratios. In all three cases the full-value assessment resulted in an average assessment that was closer to the market value of the property, a more accurate assessment

TABLE IV

"T" TEST FOR SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN 1964-65 ASSESSMENT-SALES RATIO ADJUSTED TO 91.57 AND THE 1966-67 ASSESSMENT-SALES RATIO

Research Areas	T Values	Degrees Freedom	Direction of Change[a]	95 Percent	99 Percent
I-A-1	1.640	62	–	No	No
I-A-2	2.550	61	+	Yes	No
II-A-1	2.710	67	+	Yes	Yes
II-A-2	0.070	63	–	No	No
I-B-1	2.860	58	+	Yes	Yes
I-B-2	1.880	80	+	No	No
II-B-2	0.404	74	+	No	No
II-B-3	1.780	68	–	No	No
II-B-4	0.159	71	+	No	No
II-B-5	0.128	77	+	No	No
III-B-1	0.516	71	–	No	No
III-B-2	1.307	57	–	No	No
III-B-3	0.945	66	+	No	No
I-C-1	2.620	59	+	Yes	Yes
II-C-1	0.307	68	–	No	No
II-C-2	0.595	64	+	No	No
II-C-3	1.156	66	–	No	No
II-C-4	1.934	80	–	No	No
III-C-1	0.577	64	+	No	No
III-C-2	0.509	65	–	No	No
III-C-3	0.562	71	–	No	No
III-C-4	1.620	72	–	No	No

[a] The direction of change shows whether the revaluation resulted in an assessment-sales ratio *closer to* 100 percent than the adjusted 1964-65 ratio or in an assessment ratio *not as close*. An improvement in the assessment-sales ratio is indicated by a +; the reverse is indicated by a –.

on the average. Two of the three improved ratios were in the low-valued residential properties, the I row, with one in each age column. The third was in the next-highest value range, row II, the middle range.

When the confidence interval is lowered to 95 percent, only one additional difference shows up. At this level there are significant differences between four of the mean assessment ratios or 18 percent of the areas. Of this one additional, significantly different ratio, the ratio for the 1966-67

period is further from 100 percent than the adjusted 1964-65 ratio. This group is in the low-value group.

It appears that effects of the full-value assessment on the assessment-sales ratio of properties in the areas under study were only a slight improvement. The assessment did result in 13.5 percent of the areas having assessments closer to a target assessment-sales ratio, but the earlier discussion of target ratios, publicly known goal ratios, and existing ratios must be noted. Without reservation, one could conclude that low-valued houses were the most affected, having their assessment-sales ratios raised in relation to the other property classes. The high-valued properties were least affected.

Determining the Effect of the Revaluation on the Rate of Assessment for General Categories of Residential Properties

To further analyze the effects of the full-value assessments on the assessment-sales ratios, the researchers made a second analysis. The individual research areas were collected into eight value-age categories. For example, the I-A-1 and the I-A-2 research areas were grouped into the general I-A category. This category included the old, low-valued residences. By referring to Table II, and the descriptions of the general areas preceding this table, one can see how the general categories analyzed here were made. This grouping was done in order to analyze the effects of the assessment on these general categories of residential properties. The assessment-sales ratio for each category and for each period was compared to the ratio of each of the other seven categories in the same respective period. For example, the mean ratio for the I-A class for 1964-65 was compared to the mean ratio of the II-A class for 1964-65 period, and the I-A 1966-67 mean ratio was compared to the II-A 1966-67 ratio. The "T" test was used to test for a significant difference between the mean assessment-sales ratios.

If a significant difference existed between the ratios for the 1964-65 period but not for the 1966-67 period one would conclude the assessments were more nearly equal for the two groups after the full-value assessments. For example, when the mean ratio of the I-A category for 1964-65 was compared to the mean ratio of the II-A category for the 1964-65 period, there was no significant difference between the two mean ratios. When the mean ratio for the I-A category for the 1966-67 period was compared to the mean ratio for the II-A category for the 1966-67 period, again there was no significant difference between the two mean ratios. The conclusion could be made, therefore, that before the revaluation the general level of assessment was about the same for both classes of property. Also, after the revaluation, the general level of assessment was about the same for both classes of property. Therefore, the revaluation did not significantly affect the equity of the general level of assessment between I-A properties and II-A properties. By examining the subsequent tables (Tables V-XIV), one may determine how the level of the assessment for a group compared to that of the other groups and how the full-value assessment affected

their relationships. If the full-value assessment had reduced the degree of inequities in the rate of assessment of different property classes, there would have been a reduction in the number of significant differences between the mean ratios in the 1966-67 period.

I-A Properties, Old, Low-Valued Houses, Compared to Other General Categories

For class I-A, the old, low-valued houses, the mean assessment ratio did not differ significantly from the mean ratio of the other classes for either period. The main conclusion to be drawn from Table V is that the I-A class of property was assessed at about the same level as the other classes of property prior to the full-value assessment. After the full-value assessment this equality of assessment rates was maintained. Both before and after the assessment the average ratio of class I-A was slightly below the overall average.

II-A Properties, Old, Middle-Valued Houses Compared to Other Categories

The mean assessment-sales ratio for the class II-A properties varied from the mean ratios of some of the other property classes. For the 1964-65 period, there was a significant difference between the mean ratio of class II-A and the ratios of II-B, the middle-aged, middle-valued houses; II-A and II-C, new, middle-valued homes; and II-A and III-C, new, upper-valued homes. In all these cases, the II-A mean assessment was at a lower rate than for the other classes. Also, in all four comparisons there was no significant difference between the mean ratios after the full-value assessment. For the 1966-67 period, in only one comparison was there a significant difference between the mean ratios. The mean ratio for class II-A differed significantly from the mean ratio of class I-B, middle-aged, low-valued houses, the ratio for class II-A smaller than for I-B. Since there was no significant difference between the ratios for the 1964-65 period, one can conclude that the full-value assessment resulted in a more unequal rate of assessment for the two classes. The final general conclusion to be drawn from Table VI is: Class II-A properties, before the reassessment, were assessed at approximately the same rate as those in the other classes with the exceptions noted above. The full-value assessment brought the assessment rate of class II-A up to the same level as for the four classes of new properties, thus making the assessment rates more nearly equal, with the exception noted.

I-B Properties, Middle-Aged, Low-Valued Houses, Compared to Other Categories

The results in class I-B, middle-age, low-valued houses, were similar to those for II-A. In three cases the full-value assessment brought the assessment rate of class I-B up and more nearly in line with II-B, middle-age, middle-valued houses; II-C, new, middle-valued houses, III-C new, upper-valued houses. In one class the reassessment made the difference between

TABLE V

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP I-A AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
I-A	27.91		II-A	25.90	1.12	No	No
I-A	88.50		II-A	89.72	0.22	No	No
I-A	27.91		I-B	26.63	0.31	No	No
I-A	88.50		I-B	91.56	0.62	No	No
I-A	27.91		II-B	28.64	0.45	No	No
I-A	88.50		II-B	90.71	0.46	No	No
I-A	27.91		III-B	28.41	0.24	No	No
I-A	88.50		III-B	89.40	0.18	No	No
I-A	27.91		I-C	27.53	1.33	No	No
I-A	88.50		I-C	95.48	0.22	No	No
I-A	27.91		II-C	27.53	0.14	No	No
I-A	88.50		II-C	93.94	1.13	No	No
I-A	27.91		III-C	30.79	1.69	No	No
I-A	88.50		III-C	92.26	0.77	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

I-B and II-A worse, I-B now being assessed at an even higher rate than II-A, old, middle-valued houses. After the reassessment, the assessment rate of I-B was brought up to approximately the average of all the classes, especially the higher-valued properties (Table VII).

II-B Properties, Middle-Aged, Middle-Valued Houses, Compared to Other Categories

For class II-B, the results are similar to those seen in the previous two classes. Class II-B, middle-valued, middle-aged residences, had a ratio that was significantly different from the mean ratio for 1964-65 of class II-A, I-B, and III-C. In the 1966-67 period, these significant differences were removed as the assessments for lower-valued properties were brought up to be relatively more in line with class II-B and the relative rates of the high-valued properties were reduced to be more in line with the rates for II-B. In one instance, the difference between class mean ratios was increased to the significant level by the full-value assessment (Table VIII).

TABLE VI

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP II-A AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	Degree of Confidence 99 Percent
II-A	25.90	I-A	27.91	1.12	No	No
II-A	89.72	I-A	88.50	0.22	No	No
II-A	25.90	I-B	26.63	0.24	No	No
II-A	89.72	I-B	91.56	1.96	Yes	No
II-A	25.90	II-B	28.64	3.11	Yes	Yes
II-A	89.72	II-B	90.71	0.34	No	No
II-A	25.90	III-B	28.41	2.24	Yes	No
II-A	89.72	III-B	89.40	0.11	No	No
II-A	25.90	I-C	27.53	1.55	No	No
II-A	89.72	I-C	95.48	1.58	No	No
II-A	25.90	II-C	29.42	3.79	Yes	Yes
II-A	89.72	II-C	93.94	1.47	No	No
II-A	25.90	III-C	30.79	4.57	Yes	Yes
II-A	89.72	III-C	92.26	0.86	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

The assessment resulted in a greater difference between the ratio of class II-B and class II-C, a class of new homes. After the assessment, II-B property was assessed at a relatively lower rate than class II-C property.

III-B Properties, Middle-Aged, High-Value Houses, Compared to Other Categories

In the case of class III-B, middle-aged, high-value homes, no significant trend was noticeable. The assessment rates were improved between III-B and II-A and III-C but worsened between III-B and I-C. The relative rates for III-B were, on the average, lowered by the reassessment (Table IX).

I-C Properties, New, Low-Value Houses, Compared to Other Categories

The table for class I-C (Table X) also shows inconclusive results for the full-value assessment. In the case of class III-B the reassessment resulted in a significant difference between the two mean ratios with I-C now being assessed at a relatively higher rate than III-B. In the comparison

TABLE VII

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP I-B AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
I-B	26.63	I-A	27.91	0.31	No	No
I-B	91.56	I-A	88.50	0.62	No	No
I-B	26.63	II-A	25.90	0.24	No	No
I-B	91.56	II-A	89.72	1.96	Yes	No
I-B	26.63	II-B	28.64	3.61	Yes	Yes
I-B	91.56	II-B	90.71	0.57	No	No
I-B	26.63	III-B	28.41	1.37	No	No
I-B	91.56	III-B	89.40	1.13	No	No
I-B	26.63	I-C	27.53	1.23	No	No
I-B	91.56	I-C	95.48	1.43	No	No
I-B	26.63	II-C	29.42	5.17	Yes	Yes
I-B	91.56	II-C	93.34	1.34	No	No
I-B	26.63	III-C	30.79	5.54	Yes	Yes
I-B	91.56	III-C	92.26	0.38	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

of two other classes, II-C and III-C, the reassessment improved the differences between mean ratios bringing I-C up to the relative rates of II-C and III-C. In general the reassessment increased the assessment rates of I-C from the average level to a rate in 1966-67 that was above the average assessment rate.

II-C Properties, New, Middle-Value Houses Compared to Other Categories

For class II-C, new, middle-valued houses, a more definite improvement trend can be seen. In the cases of II-A, I-B, I-C, and III-C the reassessment created a more equal assessment rate by bringing these class rates up more in line with class II-C. In the case of class II-B the rates were made relatively more unequal (Table XI).

III-C Properties, New, High-Valued Houses, Compared to Other Categories

With class III-C, new, upper-valued homes, the results of the assessment

TABLE VIII

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP II-B AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	Degree of Confidence 99 Percent
II-B	28.64	I-A	27.91	0.450	No	No
II-B	90.71	I-A	88.50	0.460	No	No
II-B	28.64	II-A	25.90	3.110	Yes	Yes
II-B	90.71	II-A	89.72	0.340	No	No
II-B	28.64	I-B	26.63	3.610	Yes	Yes
II-B	90.71	I-B	91.56	0.570	No	No
II-B	28.64	III-B	28.41	0.280	No	No
II-B	90.71	III-B	89.40	0.808	No	No
II-B	28.64	I-C	27.53	1.540	No	No
II-B	90.71	I-C	95.48	1.870	No	No
II-B	28.64	II-C	29.42	1.470	No	No
II-B	90.71	II-C	93.94	2.360	Yes	No
II-B	28.64	III-C	30.79	2.870	Yes	Yes
II-B	90.71	III-C	92.26	1.010	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

were most beneficial. Generally III-C had been assessed at a higher rate than had the other classes prior to the revaluation, but afterward its rates were lowered relative to the other classes. The relative differences in assessment rates were reduced for all classes except class II-C. In this case the reassessment made no significant improvement (Table XII).

In summary, the class comparison tables (Tables V-XII) show several developments. Over all, there was some improvement in that the rates of assessment after reassessment were more equal among the various property classes. However, exceptions to this generality were found. The least affected group was of the old, low-valued houses, I-A. Prior to the full-value assessment, the rate for this class was approximately equal to that of the other classes. The assessment made no significant changes in their relationships. These results at first might appear inconsistent with the results found in Table III. A closer examination will show there is no inconsistency. From Table IV it is concluded that the revaluation definitely changed the mean assessment rates of individual research groups within the general

TABLE IX

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP III-B AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
III-B	28.41	I-A	27.91	0.240	No	No
III-B	89.40	I-A	88.50	0.180	No	No
III-B	28.41	II-A	25.90	2.240	Yes	No
III-B	89.40	II-A	89.72	0.110	No	No
III-B	28.41	I-B	26.63	1.370	No	No
III-B	89.40	I-B	91.56	1.130	No	No
III-B	28.41	II-B	28.64	0.280	No	No
III-B	89.40	II-B	90.71	0.808	No	No
III-B	28.41	I-C	27.53	0.920	No	No
III-B	89.40	I-C	95.48	2.303	Yes	No
III-B	28.41	II-C	29.42	1.240	No	No
III-B	89.40	II-C	93.94	1.520	No	No
III-B	28.41	III-C	30.79	2.470	Yes	No
III-B	89.40	III-C	92.26	1.710	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

I-A category. Some assessment rates were significantly raised. Other rates were significantly lowered. For the I-A category as a whole, these changes largely averaged out. In Table V a different analysis was made which showed the effect of the revaluation on the rate of assessment of properties in category I-A relative to other categories of properties.

The class for which the relative assessment level was most affected was of the new, high-valued properties. This class had been assessed at a higher rate than had most of the other classes. The reassessment lowered this rate, making it relatively equal to the rates for the other classes. Between these two extremes the results were mixed. After the full-value assessment the majority of the classes kept the relative levels they had held in the 1964-65 period. Classes II-A and II-C had ratios that were substantially more equal to the rates of the other classes after the revaluation. In the case of class II-A its average assessment rate was raised to a level more nearly in line with the rates of the other classes. In the case of class II-C the assessment rates of the other classes were raised relative to its

TABLE X

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP I-C AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
I-C	27.53	I-A	27.91	1.330	No	No
I-C	95.48	I-A	88.50	0.220	No	No
I-C	27.53	II-A	25.90	1.550	No	No
I-C	95.48	II-A	89.72	1.580	No	No
I-C	27.53	I-B	26.63	1.230	No	No
I-C	95.48	I-B	91.56	1.430	No	No
I-C	27.53	II-B	28.64	1.540	No	No
I-C	95.48	II-B	90.71	1.870	No	No
I-C	27.53	III-B	28.41	0.920	No	No
I-C	95.48	III-B	89.40	2.303	Yes	No
I-C	27.53	II-C	29.42	2.670	Yes	Yes
I-C	95.48	II-C	93.94	0.618	No	No
I-C	27.53	III-C	30.79	3.700	Yes	Yes
I-C	95.48	III-C	92.26	1.250	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

rate. Although the results are so mixed, one could say the new, middle- and upper-class houses were assessed at a higher rate than the other classes prior to the reassessment. The full-value assessment increased the assessment rates of most of the other classes relative to these two classes.

Determining the Effect of the Revaluation on the Rate of Assessment for Age and Value Groupings of Residential Properties

In order to make more gross generalizations about the effects of the full-value assessments, two additional analyses were made; one grouping the properties according to the age of the property, and the other grouping the property according to the value of the property. To avoid intercorrelation between value and age, a selected sample was drawn to be sure that the groups of different ages had properties of all value ranges with no predominance of any value class. The same was done for the value groups; that is each value group was selected to contain properties of all ages with

TABLE XI

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP II-C AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
II-C	29.42	I-A	27.91	0.140	No	No
II-C	93.94	I-A	88.50	1.130	No	No
II-C	29.42	II-A	25.90	3.790	Yes	Yes
II-C	93.94	II-A	89.72	1.470	No	No
II-C	29.42	I-B	26.63	5.170	Yes	Yes
II-C	93.94	I-B	91.56	1.340	No	No
II-C	29.42	II-B	28.64	1.470	No	No
II-C	93.94	II-B	90.71	2.360	Yes	No
II-C	29.42	III-B	28.41	1.240	No	No
II-C	93.94	III-B	89.40	1.520	No	No
II-C	29.42	I-C	27.53	2.670	Yes	Yes
II-C	93.94	I-C	95.48	0.618	No	No
II-C	29.42	III-C	30.79	1.760	Yes	No
II-C	93.94	III-C	92.26	1.180	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

no predominance of any age group. The selection of these samples out of the original sample was done intentionally after the original sample areas had been grouped according to value and then grouped according to age (Table II). For example, the horizontal row 1 includes low-valued properties of all ages. The vertical column C includes new residences of all value groups.

The rates of assessment of the different age groups and the different value groups for the different periods were compared in the same manner as were the comparisons between different categories. The method of interpretation of Tables XIII and XIV is the same as for the previous series of tables (Tables V-XII) except that the classes of property are not as specific as in these previous tables. If there is no change in the difference between the average assessment ratio for two classes for the two periods, 1964-65 and 1966-67, the implication is that the full-value assessment had little effect on the relative rates of assessment for the two classes. A change in the difference between the ratios for the two classes

TABLE XII

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF GROUP III-C AND THE OTHER RESEARCH GROUPS

Research Group*	Mean Ratio	vs. Research Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
III-C	30.79	I-A	27.91	1.690	Yes	No
III-C	92.26	I-A	88.50	1.770	No	No
III-C	30.79	II-A	25.90	4.570	Yes	Yes
III-C	92.26	II-A	89.72	0.860	No	No
III-C	30.79	I-B	26.63	5.540	Yes	Yes
III-C	92.26	I-B	91.56	0.380	No	No
III-C	30.79	II-B	28.64	2.870	Yes	Yes
III-C	92.26	II-B	91.56	0.457	No	No
III-C	30.79	III-B	28.41	2.470	Yes	No
III-C	92.26	III-B	89.40	1.710	No	No
III-C	30.79	I-C	27.53	3.700	Yes	Yes
III-C	92.26	I-C	95.48	1.250	No	No
III-C	30.79	II-C	29.42	1.760	No	No
III-C	92.26	II-C	93.94	1.180	No	No

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

for the two periods would indicate that the assessment rates were brought relatively closer together or farther apart, depending on the direction of change.

The Effects of the Revaluation on the Rate of Assessment of Homes of Different Ages

The table comparing the average assessment ratio for groups delineated according to age shows that the full-value assessment had a slight effect on differences in assessment rates for different-aged residences (Table XIII). As was suspected, older houses were assessed at a lower rate than were newer houses and the full-value assessment made a significant improvement in this difference in rates. Although there was no significant difference between the assessment rates for the old and middle-valued houses, both before and after the reassessment, there was a difference in rates for the middle-aged and new properties before the reassessment.

TABLE XIII

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF AGE GROUP A, B, AND C

Age Group[a]	Mean Ratio	Age Group	Mean Ratio	T	Degree of Confidence 95 Percent	99 Percent
A	26.82	B	28.09	1.440	No	No
A	89.15	B	90.42	0.460	No	No
A	26.82	C	29.85	3.250	Yes	Yes
A	89.15	C	93.35	1.650	No	No
B	28.09	A	26.82	1.440	No	No
B	90.42	A	89.15	0.460	No	No
B	28.09	C	29.85	3.360	Yes	Yes
B	90.42	C	93.35	3.000	Yes	Yes
C	29.85	A	26.82	3.250	Yes	Yes
C	93.35	A	89.15	1.650	No	No
C	29.85	B	28.09	3.360	Yes	Yes
C	93.35	B	90.42	3.000	Yes	Yes

[a] Age Group A is composed of houses built before World War II.
Age Group B is composed of houses built in the period from 1945 to 1960.
Age Group C is composed of houses built after 1960.

[b] Upper row of each pair is for *before*, lower for *after*, full-value assessment.

The middle-aged properties were assessed at a lower rate than were the new properties, but the revaluation did not significantly reduce the differences in their assessment rates. In the past, property assessments were not updated accurately. Thus, as land values, building costs, property values, etc., rose, the assessments of older properties were not raised rapidly enough, or in sufficient amounts, to reflect the rising values. The new properties had updated assessments which had not had time to deteriorate and consequently were at a higher rate than for the older properties. The revaluation updated the assessments of older properties more than it did those of the newer.

The lack of a significant difference between the old- and middle-aged property assessments is more difficult to explain. Though the average assessment rates for the old properties were lower than for the middle-aged, the difference was not significant at the 95 percent level. According to the explanation for the higher rates for the new properties, one would expect the rate for the middle-aged properties to be significantly higher than the rate for the old properties. Over the years, efforts have been made to

update the assessments of properties. Such an effort took place in the early 1950's. Also, when a property assessment got outrageously out of line, attempts were made to rectify the poor assessment. Due to such efforts, the assessments on older properties were brought closer to the assessments on middle-aged properties. In the early 1960's, building costs, land values, etc., began to rise rapidly, causing a rapid escalation of property values. At the same time, records throughout the state indicated a failure on the part of the assessors to update the assessments to these rising values.[1] The combination of these factors could explain the lack of a significant difference in the rates on new properties and the rates on the old- and middle-aged properties.

The Effects of the Revaluation on the Rate of Assessment on Houses of Different Values

The second aggregate comparison groups residences according to value, low, middle, and high. The specific values delineating these cases are those discussed earlier. Table XIV shows that the full-value assessment had beneficial effects in equalizing the assessment rates for the different value groups of properties. The lowest-valued properties, prior to the reassessment, were assessed at a rate significantly lower than the other two groups, and the middle-valued properties were assessed at a significantly lower rate than the highest valued properties. After the full-value assessment there was no significant difference between the assessment rates for any value group. Without doubt, the full-value assessment had its greatest effect on the assessments of different-valued properties.

The fact that prior to the reassessment the lower-valued properties were assessed at a lower rate than the middle or upper-valued properties was somewhat of a surprise. Usually, the assumption is that the reverse conditions exist. This finding agrees with other research done in the Louisville area.[2] Normally, the explanation for the lower-assessment rate on low-value houses would be connected with an age assumption. Lower-priced residences are more frequently found in the older sections of a city. In these sections fewer sales occur to serve as a basis for reassessment. Also, in these areas the assessment ratios are traditionally not raised during periods of rising property values. The combination of a poor basis for reassessment and failure to reassess ordinarily results in lower average assessment-sales ratios for low-valued properties. However, this explanation is not acceptable in the analysis made here because the age variable has been "controlled" in the sample.

The best explanation for the low assessment-sales ratio for lower-valued property lies in the fact that there is a broader demand in the market for

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[1] Tax Research Center of Western Kentucky University, *op. cit.*, p. 17.

[2] Virgil L. Christian, "Regressivity in Assessment—Fact or Myth," Unpublished Paper, University of Kentucky, 1967.

TABLE XIV

"T" TEST FOR SIGNIFICANT DIFFERENCE BETWEEN THE ASSESSMENT-SALES RATIO OF VALUE GROUP I, II, AND III

Group[a]* Value	Mean Ratio	Value Group	Mean Ratio	T	Degree of Confidence 95 Percent	Degree of Confidence 99 Percent
I	27.26	II	28.42	2.000	Yes	No
I	91.46	II	91.83	0.183	No	No
I	27.26	III	29.87	3.670	Yes	Yes
I	91.46	III	90.97	0.251	No	No
II	28.42	I	27.26	2.000	Yes	No
II	91.83	I	91.46	0.183	No	No
II	28.42	III	29.87	2.670	Yes	Yes
II	91.83	III	90.97	0.236	No	No
III	29.87	I	27.26	3.670	Yes	Yes
III	90.97	I	91.46	0.251	No	No
III	29.87	II	28.42	2.670	Yes	Yes
III	90.97	II	91.83	0.256	No	No

[a] Value Group I is composed of houses whose values are less than $13,000.
Value Group II is composed of houses whose values are between $13,000 and $21,000.
Value Group III is composed of houses whose values are greater than $21,000.

* Upper row of each pair is for *before*, lower for *after*, full-value assessment.

lower-valued houses. Such demand tends to push up the values of these houses more rapidly. In the high-valued houses, often the house is custom built and features are included, at premium construction costs, which did not have a substantial resale value on the general market. As a result, the rate of appreciation of such houses is not as great as that of the more homogeneous low-priced homes. Where the rate of appreciation is more rapid, as in the case of low-valued homes, the assessment rate tends to lag behind the ratios for the other classes. The reassessment corrected this lag effect.

A conclusion can be made, on the basis of the tables showing the effects of the full-value assessment on properties grouped according to age and value, that the reassessment made little or no improvement in the inequities among the rates of assessment between the property groups of different ages but that substantial improvements were made between the groups of different value ranges. Several factors enter into the explanation of this

difference of effect. The older the group of residences, the fewer the sales in the group and the harder it is to obtain representative sales on which to establish an accurate multiplier. Therefore the multiplier used for older homes is not as accurate. Moreover, the inaccuracy is biased toward the low side because the values of middle and older homes were rising more rapidly than the values of new homes. A multiplier based on sales in the early 1960's was used to estimate the value of a house for the later period of 1966 and 1967. For homes with faster-rising values, the assessment-sales ratio would be lower than the assessment-sales ratio of homes whose values appreciated more slowly. During the middle 1960's there was a shortage of new housing in the Lexington area and a lack of reasonably priced mortgage funds for new houses. Home buyers were forced into the middle-aged or older home market. The unusual demand for middle or older homes resulted in an increase in the values of such homes at a more rapid pace than normally expected. The assessments were less accurate for these residences; therefore, the new ratios were approximately as inaccurate as the old ratios. As a result little was done in the way of improving the difference between the average assessment ratios of new homes and middle or older homes.

THE DEGREE OF EQUITY ATTAINED BY THE FULL-VALUE ASSESSMENT

The Ambiguity of a True Market Value and the Consequent Difficulty of Obtaining an Accurate Assessment

In the minds of many assessing officials, equity is the most important objective of assessment. Unless assessments are equitable, all the other objectives and purposes of the property tax are jeapordized. If one person's property is under-assessed, the tax burden of all others not similarly favored is increased. From another viewpoint, equity for all taxpayers becomes extremely important as the local property tax burden increases. Basic equity is necessary if administrators can expect the voters to continue to pass tax increases for school needs or for additional services. Yet, equitable assessments are difficult to attain.

What is the true market value of a piece of property? This question has no precise answer. There is no such thing as a true value. The various valuation techniques yield different results. Every assessment is hypothetical and the assessor is confronted with uncertainty. Since the assessment is an estimate of the market value, there will be some variation in different assessments of the same property or similar properties. The market place itself is a highly variable thing. Fluctuating credit conditions, pride of ownership, and many other factors vary widely from transaction to transaction. A given buyer-seller couple may agree upon a widely different selling price from the one upon which another buyer-seller couple would agree, or upon which the original couple would agree the next day. Property may sell for one figure today and for another figure tomorrow, even when all sellers are willing sellers and all buyers are willing buyers. Consequently, 100-percent assessment made one day may not be 100 percent the next day. A more accurate definition of the assessment-sales ratio should be: The assessor's estimate of hypothetical market value divided by the buyers' and sellers' estimate of hypothetical market value.

Once reasonable equity is achieved, there is still a constant battle to maintain fair treatment for even a few years because of the constant fluctuation of market values. No assessor can maintain reasonable equity for even most taxpayers beyond a few years without a complete revaluation of all properties. This inability to maintain accurate assessments is due to several factors. Values, even for neighboring properties, do not generally move as a group but ebb and flow on an individual basis governed by the everchanging likes and dislikes of the buying public. Sudden population influxes greatly affect values. Individual maintenance, another factor with great impact on value, varies from house to house and year to year. The

passage of a few years can bring out major differences in value even in a neighborhood of basically similar homes.

In short, the market is less than a perfect model, making the assessment process for the individualized property difficult. Secondly, the constant changes in the market necessitate a continuing renewal of the assessment if it is to maintain accuracy. Obviously, for a large urban area such as Lexington where rapid growth and change and a large number of individual properties exist, the task of maintaining a precisely accurate assessment is not only impracticable but impossible. Realizing this fact, assessing officials have tried to determine satisfactory levels of inequity, or variation in assessments, permissible with the best assessing techniques. What the assessors say is: Under existing market conditions and with existing assessing techniques, variation of assessment rates is unavoidable; however, this variation can be kept to a certain minimum with the best techniques and administration available.

The measure of the degree of uniformity and equity of assessment valuations is the coefficient of variation. This statistic measures the degree that the individual assessment-sales ratio differs from the mean assessment-sales ratio. It is a measure of relative variation, expressing the magnitude of the variation in relation to the size of an assessment-sales ratio in question. The lower the figure, the more equitable are the assessments. Twenty percent is generally regarded as good.[1] However, when one remembers that many of the assessments must be out by more than 20 percent when a coefficient of 20 percent exists, he quickly realizes that even a 20-percent average dispersion is somewhat faulty. Individuals with inequitable assessments doubt the assessor. Yet, the assessor, by following the 20-percent rule, honestly feels he has obtained an equitable assessment.

The Patterns of Inequities in Assessments as Determined From the Coefficient of Variation for Individual Research Areas for 1964-65 and 1966-67

One of the chief complaints against the old fractional assessment system in Kentucky was that it led to great inequities in individual assessments. Using the coefficient of variation, one can determine the effects of the full-value assessment on the equity between individual assessments and between assessments for different types of properties.

Accordingly, the coefficient of variation was determined for each research area for the 1964-65 period and for the 1966-67 period respectively (Table XV). As previously pointed out, the coefficient of variation for a research area shows the degree of equity of the assessments of the properties in this area. The higher the coefficient, the more is the variation in the assessment-sales ratios of the individual properties and, therefore, the more

[1] Ray Beach, "Measuring the Results of Assessment-Sales Ratio Studies," *Assessor's News Letter*, XXXII, No. 1 (January, 1966), p. 78.

TABLE XV

THE EQUITY OF THE ASSESSMENTS IN DIFFERENT PROPERTY CLASSES BEFORE AND AFTER THE FULL-VALUE ASSESSMENT
(Measured by the Coefficient of Variation in Each Class)

Research Area	1964-65 Coefficient of Variation	1966-67 Coefficient of Variation
I-A-1	53.35	40.07
I-A-2	34.08	41.46
II-A-1	26.41	24.17
II-A-2	30.85	21.49
I-B-1	11.96	9.94
I-B-2	14.26	14.83
II-B-2	10.96	10.52
II-B-3	13.44	15.79
II-B-4	14.64	14.89
II-B-5	27.67	13.71
III-B-1	28.82	13.99
III-B-2	27.81	17.04
III-B-3	19.52	15.79
I-C-1	12.17	13.18
II-C-1	9.64	8.44
II-C-2	20.29	16.52
II-C-3	16.00	9.92
II-C-4	15.52	8.31
III-C-1	16.99	16.83
III-C-2	11.98	14.58
III-C-3	33.24	11.39
III-C-4	32.54	12.46

inequitable the assessment. The coefficient of variation for the pre-revaluation period ranged from a high of 53.35 percent for the I-A-1 area to 9.64 percent in the II-C-I area. It should be realized that in judging these results by the 20-percent standard, the 20-percent rule was applied to a large area of residences. The research groups were broken down into smaller and much more homogeneous areas. As a result of the increasing homogeneity of the properties in each group, the coefficient of variation within the group should be less than 20 percent.

On the basis of Table XV, several conclusions can be reached about the degree of equity of the assessments on the individual sample areas. The old properties (Group A) had the greatest variation. Also, the high-valued

properties had greater variations than the I-B and I-C and the II-B and II-C classes. Such patterns of variation were expected. Older houses were more difficult to assess. There were fewer sales of older houses from which to make comparative sales estimates. The older the house, the less meaningful becomes the cost-of-replacement approach to assessment. As time passes, housing styles, construction materials, construction methods, consumer tastes, etc., change radically. Furthermore, individual maintenance varies widely as do general neighborhood conditions. Often, before the reassessment, assessments on old properties would not be changed over the years unless the property was sold. As a result, as some properties appreciated in value, their assessment rates fell to very low levels, while other properties were sold and then reassessed at the normal rate. Still other properties depreciated in value over the years while their assessments remained the same, resulting in higher ratios for these properties. Large variations in the rates of assessment were bound to occur with such practices.

In the case of higher-valued properties, the higher levels of variation can be attributed to the difficulty of accurately assessing these properties. As discussed previously, there was more heterogeneity among the individual properties in the higher-valued groups. General rules for assessing on a mass basis do not work as well with such houses. In assessing such houses, the cost approach, determining the value of the property by determining the cost of construction, was often used. Many high-value homes have special features in them to suit personal desires. Such accessories add significantly to construction costs but often are not as highly valued on the resale market. In these cases, assessments based on construction costs do not closely approximate the market value of the house. Furthermore, the most successful claimants before the board of appeals are high-valued property owners.[2] Board assessment reductions often adversely affect the final assessment-sales ratio.

Determining the Effect of the Revaluation on the Equity of the Property Assessments in the Research Areas

Many of these causes of assessment inequities in the older and the high-valued residences could have been corrected by a new assessment of the property. To determine the effects of the revaluation on the equity of residential assessments, the coefficient of variation of the individual research areas for the 1964-65 period was compared to the coefficient of variation for the same area for the 1966-67 period. The "T" test was used to test for a significant difference between the two coefficients. The results of the comparisons appear in tabular form in Table XVI. One should not only observe whether the reassessment resulted in a significant difference

[2] Interview with J. Earl O'Bryant, Deputy Tax Commissioner of Fayette County, June 14, 1969.

TABLE XVI

"T" TEST FOR A SIGNIFICANT DIFFERENCE BETWEEN THE COEFFICIENT OF VARIATION OF INDIVIDUAL GROUPS FOR THE PERIODS 1964-65 AND 1966-67

Research Group	Coefficient of Variation		Direction of Change[a]	T Values	Confidence Level 95 Percent	Confidence Level 99 Percent
	1964-65	1966-67				
I-A-1	53.35	40.07	+	1.600	No	No
I-A-2	34.08	41.46	−	1.093	No	No
II-A-1	26.41	24.17	+	0.515	No	No
II-A-2	30.85	21.49	+	2.040	Yes	No
I-B-1	11.96	9.94	+	1.010	No	No
I-B-2	14.26	14.83	−	0.244	No	No
II-B-2	10.96	10.52	+	0.144	No	No
II-B-3	13.44	15.79	−	0.944	No	No
II-B-4	14.64	14.89	−	0.102	No	No
II-B-5	27.67	13.71	+	4.140	Yes	Yes
III-B-1	28.82	12.59	+	4.160	Yes	Yes
III-B-2	27.81	14.95	+	3.140	Yes	Yes
III-B-3	19.52	14.21	+	1.790	Yes	No
I-C-1	12.17	13.18	−	0.439	No	No
II-C-1	9.64	8.44	+	0.779	No	No
II-C-2	20.29	16.52	+	1.170	No	No
II-C-3	16.00	9.92	+	1.380	No	No
II-C-4	15.52	8.31	+	2.160	Yes	No
III-C-1	16.99	16.83	+	0.054	No	No
III-C-2	11.98	14.58	−	1.120	No	No
III-C-3	33.24	11.39	+	11.940	Yes	Yes
III-C-4	32.54	12.46	+	5.180	Yes	Yes

[a] A + sign signifies a decrease in the coefficient of variation (increase in the equity of the assessments in the research area).

A − sign signifies an increase in the coefficient of variation (a deterioration of the equity of the assessments in the research area).

in the coefficient of variation for the two periods but also the direction of the change. In some cases, the 100-percent assessment caused an increase in the variation of the assessments in the particular class.

Considering the individual research areas generally, one may conclude that the full-value assessment was successful in improving the equity of the property assessments. At the 95-percent confidence level, impro

ments were made in 8 of the 22 research areas. At the 99-percent confidence level, 6 improvements were made. Noteworthy is the fact that, with the exception of the older properties, the improvements were made in the classes that had the least equitable assessments (the largest coefficients of variation). In other words, where no significant improvements were made, the coefficients of variation were already well under the 20-percent level. Where the coefficient of variation was close to 10, as was the case with class II-B-2 or II-C-1, the argument could be made that the degree of equity attained before the revaluation was as great as possible.

Determining the Effect of the Revaluation on the Equity of the Assessments on Different-Aged Residential Properties and on Different-Valued Residential Properties

For analysis of the effects of the revaluation on assessment equity, the individual research areas were grouped into categories according to age and also grouped into categories according to value. The grouping procedure was the same as that used for grouping the data presented in Table XIII for age groups and Table XIV for value groups. By going back to Table II and noting the value rows and the age columns, one can better understand the groupings done for this coefficient of variation analysis.

The analysis for the age groupings revealed the beneficial results of the full-value assessment. Significant improvements were made in the degree of assessment equity of middle-aged and new residential properties. The improvements can be attributed to the following factors: The multiplier method used in the revaluation is based on actual market sales. This method provided a more accurate assessment than did the assessments on these properties before 1966. The old assessments had been derived in more than one manner. A good, single assessment method should result in a more uniform assessment. Even more important, the full-value assessment updated the assessments on these houses, thereby yielding more equitable assessments. The revaluation failed to increase the equity of the assessments of older properties because of the difficulty of obtaining representative sales of these properties. This problem has already been discussed.

The coefficient of variation analysis for the value groups also revealed the beneficial effects of the full-value assessment. More equitable assessments were obtained for high-valued homes. The primary reason for the improvement in the equity of the assessments for the high-valued properties was the reliance on actual market sales as the basis for the new assessments. Comparative, actual market sales would obviously provide a more accurate basis for estimate of the market value of the house. The decrease in the assessment variation for new properties can also be attributed to the fact that the new assessments were based on market valuations of the properties. Prior to the reassessment many of the properties were assessed on the cost-of-construction basis. Others were assessed on the sales-value basis. As noted above, the market-value assessments were more closely approx-

TABLE XVII

"T" TEST FOR A SIGNIFICANT DIFFERENCE BETWEEN THE COEFFICIENT OF VARIATION OF A PROPERTY AGE GROUP FOR 1964-65 AND 1966-67

Age Group[a]	Coefficient of Variation		T Value	Confidence Level	
	1964-65	1966-67		95 Percent	99 Percent
A	36.04	32.62	1.14	No	No
B	17.94	13.45	4.85	Yes	Yes
C	29.53	12.09	13.95	Yes	Yes

[a] Age Group A—houses built before World War II.
Age Group B—houses built in the period from 1945 to 1960.
Age Group C—houses built after 1960.

imated by sales data, especially for the higher-valued houses. A combination of market-value assessments and cost-of-construction assessments could be expected to result in greater assessment variation than when all the assessments were based on the market-value approach. This would be true particularly where the significant changes occurred mostly in the higher-valued properties.

The apparent failure of the revaluation to increase the equity of assessments of lower-valued residences can be attributed to the influence of classes I-A-1 and I-A-2 on the statistics for group I. Both before and after the revaluation, the IB and I-C groups had relatively equitable assessments (Table XV). The assessments for I-A groups were very inequitable both before and after the full-value assessment. The properties in the I-A groups are largely "weekly rental type" properties. Such properties are the most difficult residential properties to assess. The market in such property is highly erratic. Assessing errors are unavoidably high. With the I-A properties included in the general category of low-valued properties, the statistics for the category are sure to be significantly affected. These facts must be kept in mind in interpreting the data in Table XVII.

A Brief Summary of the Beneficial Effects of the Full-Value Assessment

Generally, the most important contribution of the actual revaluation was the improvement of the equity of assessment between individual properties (Tables XV, XVI, and XVII). When one also considers the limited improvements obtained in equalizing the assessment rates on various classes of property, he cannot doubt the over-all beneficial effects on the full-value assessment. Just how it achieved these effects has already been detailed several times in the previous analysis, but a closer look is warranted.

The improvements made by the full-value assessment were due largely

TABLE XVIII

"T" TEST FOR A SIGNIFICANT DIFFERENCE BETWEEN THE COEFFICIENT OF VARIATION OF A PROPERTY VALUE GROUP FOR 1964-65 AND 1966-67

Value Group[a]	Coefficient of Variation		T Value	Confidence Level	
	1964-65	1966-67		95 Percent	99 Percent
I	25.55	24.21	0.657	No	No
II	18.66	14.11	1.667	No	No
III	24.98	14.05	4.690	Yes	Yes

[a] Value Group I—houses whose values are less than $13,000.
Value Group II—houses whose values are between $13,000 and $21,000.
Value Group III—houses whose values are greater than $21,000.

to the actual reassessment and were, in themselves, short run in nature. Over the long run, the court rulings and precedent that precepitated the revaluation will have the most lasting effect. The establishment of market value as the assessment goal will remove many ambiguities concerning the assessor's job and the desired assessment-rate goal. It will help decrease inequities and maintain equitable assessments. It will also return revenue powers to the proper officials; however, it cannot accomplish these goals by itself. Paramount to a satisfactory property tax system is a practical means of making accurate assessments and keeping these assessments updated. The assessment of recently sold property is now easy. The sale price of the property is simply recorded as the property's assessment. However, in the case of unsold property, the assessor is still left with the problem of determining the market value of the property. Since less than two percent of all residential properties are sold each year, the assessor must establish the assessments for the large majority of the properties. Furthermore, these assessments must be continually updated. His assessments can only be as good as the assessing procedure used. The laws requiring full-value assessments did very little to change the actual assessment process. As already noted, the revaluation was done largely with a multiplier derived from comparative sales data. Updating is largely done by a combination of cost-of-construction, comparative sales, and other methods.

The results obtained by the reassessment were an improvement, but how long can the improvements be maintained without continuing reappraisals? Must the reassessment process carried out in 1965 be repeated every four years? Furthermore, although improvements were made, inequities and varying assessment rates still persist. Can improvements be made in these problem areas? To date, these questions have remained largely unanswered.

DEVELOPMENT OF THE NEW APPROACH TO MASS APPRAISING

The Fundamental Requirements of a Method of Mass Appraisal

In previous sections, several important questions were implied. Can residential property assessments for Fayette County, for example, be further improved? How can updated assessments be maintained? Must the same procedures carried out in 1965 by the county tax commissioners be repeated every four years? Is there an alternative method of mass appraising that could be used to maintain current assessments as well as provide more accurate assessments than were possible with the methods employed in 1965? This section proposes an alternative approach to mass appraising.

The law says that, for taxation purposes, property shall be assessed at its full-market value. The assessment function is a determination of the market value of a property. When applied on a mass basis, the assessment function must conform to the restraints of economy and equalization, even at the expense of a more precise assessment of the market value. Therefore, the fundamental restraints within which a mass appraisal technique must function are efficiency, equality, and accuracy.

In choosing a means of mass appraisal for assessing purposes, assessors must find a method that provides accurate assessments and treats each property equitably. The method also must be practical and economical to operate in assessing large numbers of properties. A professional assessor probably can examine a residence and give a very accurate estimate of its current market value. Assessments by such a method would be accurate and equitable; however, it would be impractical and costly. Fayette County has over 40,000 residences. Several years and an astronomical budget would be needed for a professional assessor to assess each property individually. On the other hand, the untrained layman could sit down and estimate the values of residences in the different areas. Such a method would be rapid and of relatively little cost, but it would be ridiculously erroneous. Somewhere between these two extremes there must be found methods that provide reasonable equity and accuracy along with efficiency and economy.

In 1965 after the *Rushman vs. Luckett ruling*, assessors generally decided that the best way to obtain the mass appraisal required by law was to use the multiplier method of revaluation. As discussed earlier, the multipliers used were determined from actual market values. Thus, one can say that the multiplier approach is a market-based concept. Although the method provides a fairly economical, efficient revaluation, it falls somewhat short in obtaining equity and precision. The previous analyses verify the improvements made by the multiplier approach in Fayette County and point up the inequities that still remain.

An alternative approach, which would approximate the objectives of economy, efficiency, equality, and accuracy more closely is based on a "regression model." On the basis of analysis of the current residential housing market, a number of significant variables could be isolated and incorporated into a regression model. This regression model could be used to predict the value of single-family residences. The relevant information for each residential property could be coded on computer cards, placed in the computer along with the predictive model program and an assessment for each property would be produced in short order. Since the relevant data for each individual property is already on file in the Tax Commissioner's Office, all that would need to be done would be to develop the model and transfer the data to the computer cards. After the data were coded and the model program developed, the computer could assess all the single-family residential properties in Lexington in less than ten minutes. Of course time would be required for professional assessors to check the model's assessments, but even including this time and expense, the model would provide a more economic and efficient assessment. It would also be more equitable and accurate.

The Regression Model vs. Other Methods of Mass Appraisal

The regression model approach has several advantages over the currently used means of mass appraising. The commonly used replacement-cost or construction-cost technique assesses on the basis of the cost of replacing or building the given property. Often the construction cost and market value of a property are not synonymous. Because the law stipulates that the assessment be based on the market value of a property, a means of assessing that comes closer to approximating the market value is more desirable.

Another assessing method often used is the comparable-sold-property technique. This method of assessing includes a comparison of a recently sold property to the subject property. The market price of the subject property is judged from the price of the recently sold property. Although this method may produce assessments that are closer to the market value of a property, often a closely comparable residential property is hard to find, making the task of drawing conclusions about one property from another difficult. Furthermore, when done on an individual basis this method is not practical for mass appraisal, and, when combined with the multiplier approach, the results are not as accurate as desired.

No method has been established for updating assessments that is satisfactory. Of course, as houses are sold their sale prices are recorded as their assessment—but what about the many houses that are not sold? Over a period of time, since market values are constantly in flux, assessments must be adjusted to reflect the market trends. Under the present system such revaluations of unsold properties will continue to be made largely by the periodic use of the modified multiplier system. The results undoubtedly will be similar to the results obtained by the full-value assess-

ment. The regression model approach will provide for an annual reassessment that will be more precise than present approaches and at least as efficient to perform.

A final advantage of the regression model would be that it would provide for greater uniformity in the assessment procedures used in the different areas and thus provide more equality of assessments in different districts. Under present procedures there is no standard assessment practice followed among different districts. As a result, some variation exists from district to district. The method proposed here would add more uniformity to the over-all assessing process. Although the model itself would vary some from district to district, the procedures followed in assessing individual residential properties would be the same everywhere so that there would be greater interdistrict equity.

The Basis and Fundamental Requirements of the Regression Model

The basis of the regression-model approach is to select a number of variables that can be incorporated in a model that would then be used to predict the value of single-family residences. Obviously, the most logical factors to include in such a model are those that have the greatest influence on the market value of a residential property. Many factors influence the value of a residential property. Although it would be impossible to isolate all of those which buyers and sellers take into consideration when buying a given piece of property, it is possible to establish a correlation between property values and a given set of variables. Even though precise accuracy may not be attained, hopefully results will be obtained which are accurate enough for mass appraisal purposes. One should realize that the purpose of the model is predictive, a goal quite different from a goal of "explaining." The model does not necessarily have to be a rational explanation of market functions. This means that the variables included do not have to have rational relationships to residential values but should merely add to the predictive accuracy of the model. The factors should be variables that correlate consistently with various property values.

The reason for choosing such an approach to assessing is that certain characteristics of single-family residential properties are associated with particular value classes of residential properties. Different characteristics are associated with different value classes. If such relationships can be identified and quantified, then a predictive model can be constructed. The obvious approach to identification of variables that have a significant correlation to various property values and to the quantification of these relationships is the correlation-regression model.

The first step in developing the model was to select random-sample observations from the population. The distribution of each variable tended to be normal. The sample observations were representative of the joint distribution of the variables. The variation in the dependent variable, the house value, tended to be consistently related to the independent variables. If the purpose of the model was to determine the extent of the relationship

between a specific independent variable and the market price of the house, such intercorrelation would create severely limiting restrictions on the model. Since the purpose of the model, however, was not to *explain* but to *predict* the value of the dependent variable, the intercorrelation problem was not of direct concern, though any conclusions about the relationships of the independent and dependent variables should be taken with great caution. A description of the methodology followed in establishing the model will best illustrate the manner in which the requirements of a meaningful model were met.

The Methodology Used in Deriving the Regression Model and the Data Used in the Model

The experience of quantifying and analyzing the effects of the full-value assessment of single-family residences in Lexington provided the authors of this study useful data to use in analyzing the effectiveness of the regression approach. Their general approach was as follows: (1) A new method of mass appraisal was developed; (2) after such a method was developed it was applied to reassess properties existing in 1965 to their full 1966 market value just as had been done in the mass reappraisal of 1965; and (3) the results of the new method were then directly compared to the results obtained in the full-value assessment.

Several restrictions were placed on the model in consequence of time and manpower limitations. These restrictions limit the comprehensiveness of the model. However, one should realize that such restraints are not inherent in the theory of the model but in the confined methods of research and development imposed by the circumstances. In order to develop a system that would be applicable to all types of single-family residences in Fayette County, a large sample would be required to obtain a representative cross-section. Because a substantial amount of data were needed for each observation, such an extensive sample was beyond the physical and temporal facilities available. A smaller population was needed, and the decision was made to use middle- and upper-middle-class homes in the model development. This classification was chosen because it is a relatively homogeneous group, even though there was a value range of $40,000 in the sample, from $12,000 to $52,000. Thus, a representative sample could be drawn without the requirement of a prohibitive number of observations. Furthermore, there is a higher turnover rate in this value range than for any other grouping. For this reason there were enough sales in the desired areas to permit the drawing of a representative sample of sales. It was felt that if a model could be developed for this group of residences, the feasibility of a regression approach to assessing would be established. From such ground work researchers later could develop an expanded model that would be more inclusive. First, however, the operability of such an approach had to be proved.

The particular areas chosen as being representative of middle- to higher-middle-income homes were picked from the areas used in the

revaluation analysis. Thus, the analysis results could be compared to the model results. The areas were chosen from the II-B, III-B, II-C, and III-C property groupings used in the revaluation analysis. These areas included Southland (II-B-5), Zandale (III-B-1), Deep Springs-High Acres-Dixie Plantation (II-C-2), Beaumont Park-Gardensprings (II-C-4), Stonewall (III-C-2), Gainsway (III-C-4), and Landsdowne (III-C-4). The areas give a good cross-section of contemporary, middle- to upper-middle-class homes in Lexington. A description of each area and its inhabitants can be found in the revaluation analysis. The areas also provided locational variability. Three different sections of Lexington are represented. the northeast, the southeast, and the southwest sections of the city.

Once the population and the representative areas from which the sample was drawn were delineated, the next step was the actual sampling. All valid sales in 1965 in each of these areas were obtained. The criteria of a valid sale were the same as those used in the full-value analysis. Likewise, the sources of sales data and the methods of determining sales prices were the same. A random sample of these sales was taken for each area. Area sample sizes varied from 361 to 151. The total sample included 600 observations. Up to this point the methodology used in obtaining sample data was very similar to that used in obtaining data for the full-value analysis.

The next step was to obtain detailed descriptive data on each residential sale in the sample. Any factor that might influence the sale value of a property, or that might be consistently correlated with its sale value, was desired. One important limitation of the choice of possible characteristics existed. The purpose of the model was to develop a better method of mass appraisal. It should not only be more accurate than presently employed methods, it should be at least as efficient to use as present methods. Thus, a model would be useful only if the data required for operation were readily accessible to assessors with a reasonable amount of effort and if the data did not require overly complex processing for its use in the model.

Each County Tax Commissioner has an individual data card on every residential property in his county. The card contains a variety of data on the characteristics of the property. If the characteristics could be used for the independent variables in the regression model, a model could be developed that would not require the commissioner to obtain new volumes of data. Commissioners would be assured of being able to obtain all the data necessary for using the regression method. Also, the commissioners would not have to go to great efforts and expense in obtaining the data. For such reasons, the decision was made to obtain the data needed for the model development solely from the tax commissioner's records.

With the full cooperation of the Department of Revenue in Frankfort and the Fayette County Tax Commissioner, in conjunction with the research efforts of the University of Kentucky, access was obtained to the commissioner's records, but only on a strictly confidential basis. At no time was any information on any individual property released to the public.

From these data thirty-five characteristics were selected for testing in the model. Of course, this information had to be accurate to be useful. The researchers had to rely on the accuracy of the assessors who had obtained the data. If any doubts arose about the validity of the data or if certain data were missing, the whole observation had to be rejected. As a result twenty-five observations were rejected from the original sample, leaving 575 observations in the study. The thirty-five characteristics obtained for each house were:

1. Area in the house in square feet (including built-in garages).
2. Age of the house in years.
3. Size of the lot in square feet.
4. Number of rooms in the house (hallways and bathrooms not included).
5. Number of stories (two story houses and houses that were both one- and two-story were placed in separate categories).
6. Existence of a basement [the percentage of the house was accounted for in this variable (e.g., partial basement)].
7. Whether or not the basement was finished.
8. The percentage of the basement that is finished.
9. Existence of a half-story or an attic and that part of it that is finished.
10. Number of bathrooms.
11. Number of half bathrooms.
12. Number of additional single fixtures.
13. Type of heating in the house.
14. Whether or not air conditioning exists.
15. Type of exterior wall.
16. Shape of lot (regular or irregular).
17. Whether or not the garage is separated from the house.
18. Number of porches on the house.
19. Number of terraces with the house.
20. Type of terrace.
21. Total area of the terrace.
22. Subdivision in which the house is located.
23. Section of Lexington in which the house is located (southwest, southeast, or northeast).
24. Whether or not the sale was a first sale.
25. Whether or not the first porch is under its own roof, the main roof, or is enclosed.
26. Whether or not the second porch, if there is a second porch, is under its own roof, the main roof, or is enclosed.
27. Total area of the porch(s).
28. Type of foundation under the house.
29. The type of flooring in the house, including carpeting.
30. Number of fireplaces.
31. Interior finish, dry wall, plaster, other.

32. Type of roof.
33. Types of taxes—city government, county school, county government and school, city government and school. [Although no longer differentiated in this manner, these differences existed in 1965.]
34. Front footage of the lot.
35. Lot description, regular, corner, cul de sac.
36. Sale price of the property [the dependent variable].

The quality of the data on the thirty-six variables was good with exceptions:

1. A real weakness in the data on the area in a house was the inclusion of the garage, if the garage was walled in as part of the house. Carports or separate garages were not included.
2. The number of rooms was not a highly precise number since the status of large hallways, utility rooms, etc., was indefinite.
3. Any improvements that a homeowner might have made without the knowledge of the assessor would not be included in the data, but would still affect the sale price of the property. Such improvements as additional rooms, finished basements or attics, new terraces, etc., might not have been included in the analysis for this reason.
4. The age of the house does not adequately reflect the effective age. The age figure used was calculated from the construction date. Renovations, improvements, additions, etc., made since, would alter the effective age of the house.
5. The definition of a porch was loosely constructed and included any significant overhang of the roof that was paved underneath and used by the occupants. A covered walkway might be classified in this definition as a porch.
6. The front-footage figures do not accurately reflect the front footage for houses on a corner. For corner lots the front-footage figure was that part of the lot on the street toward which the house was facing. That footage along the street at the side of the house was not counted as front footage.
7. The limitations on the accuracy of the sale value of the residence are the same as those for the sale values used in the revaluation analysis.

There are some additional characteristics that might have been included in the list. These are discussed later. One should realize that the researchers had to depend on previously recorded data because they were working with 1965 sales in 1968-69. This meant that a personal inspection of the property in order to determine meaningful characteristics was impossible. Little could be determined about the 1965 status of a property by inspecting it in 1968 or 1969. On the other hand, in answer to criticism of the choice of 1965 for the analysis period—this period had to be chosen if an accurate comparison was to be made between the results obtained from the model approach and the results obtained in the full-valuation. In answer to criticism of the large number of the variables included in the model, it

is pointed out that this larger number was chosen for a test basis. It was anticipated that as the model was refined to a workable basis the insignificant variables could be discarded; but first, the distinction had to be made between the significant and the insignificant variables. It was necessary to be sure of obtaining as many significant variables as possible. The large number of variables makes obvious the need for the large sample size in order to obtain meaningful coefficients in the regression analysis.

Once the data on each variable for all 575 observations were obtained, they next had to be arranged for the regression analysis. It was hypothesized that the value of the residence, the dependent variable, had a linear relationship to each independent variable. This proved correct for the significant variables with two exceptions. Such variables as square-footage, age, number-of-rooms, number-of-bathrooms, etc., readily lend themselves to a linear quantification. Variables representing dichotomies, such as presence of air conditioning, presence of a basement, attached or unattached garage, etc., could be quantified in a *yes* or *no* manner and thus be readily analyzed in a linear fashion.

Some variables were not so easily adapted to a regression-model quantification. These variables were lot description, location, subdivision, exterior-wall, type-of-roof, etc. In cases such as these, a close estimation could be made of the variable's effect on the dependent variable. They were then coded in accordance with their effects on the dependent variable. No weighting was done on the variables. If a certain variable was found to have a proportionately greater effect on the dependent variable (price of the property), it was felt that the effects would be proportionately consistent. Thus the effect of the independent variable could be accounted for by fitting a curvilinear relationship to the function of the property value and the specific variable. (Two significant variables were subsequently fitted with curvilinear functions.) This method of coding the variables for use in the model assumes continuous functions. Although the fitting of curvilinear functions to some of the variables allows for more complex relationships than application of a straight linear function, as hypothesized originally, the assumption is still that of a continuous rather than a discrete relationship.

Questions can be raised about the assumptions concerning the relationships of certain independent variables to the dependent variable. Certainly, one cannot obtain from the model reliable conclusions about the net effects of each variable on residential values. The high intercorrelation among the independent variables forbids such conclusions. Furthermore, little in the way of quantified relationships has been determined about the effects of various factors on residential property values. For these reasons the most likely relationships were assumed and included in the model, and the accuracy of the model as a whole was tested. Various relationships were tested in the model and variables that gave improved predictability to the model were retained. Again, it must be emphasized that the predictive nature of the model was of over-riding importance. Individual relationships

are important to the extent of improving the accuracy of the model's predictions. At best, explanations of the net effects of individual variables can only be "guestimated" from the model. The reader should realize an important point about this weakness in the model: If more accurate data and knowledge of the relationships of these variables to the market value should become available, then undoubtedly, a model could be constructed that would predict more accurately.

The data had to be coded for the computer analysis. The code used was the following:

1. X_1 = Area in square feet of floor space.
2. X_2 = Age by years.
3. X_3 = Lot size in square feet.
4. X_4 = Rooms (number).
5. X_5 = Stories: 1–1; 2–1½; 3–2; 4–a combination of one or two stories.
6. X_6 = Basement: 0–no basement; 1–part basement; 2–full basement.
7. X_7 = Finish of basement: 0–no basement; 1–unfinished; 2–finished.
8. X_8 = Percentage of finished basement: 0–none; 1–1 to 24%; 2–25 to 49%; 4–75 to 100%.
9. X_9 = Half story or attic: 0–no attic; 1–unfinished; 2–finished.
10. X_{10} = Bathroom: 1–one plain; 2–1 wainscoting; 3–1 full tiled; 4–1 plain; 5–1 wainscoting and 1 plain; 6–1 full tile and 1 plain; 7–2 wainscoting; 8–2 full tiled; 9–three plain; 10–one plain and two wainscoting.
11. X_{11} = Toilet rooms: 0, 1, 2, etc.
12. X_{12} = Single fixtures: 0, 1, 2, 3.
13. X_{13} = Heating: 1–electric; 2–gas; 3–steam.
14. X_{14} = Air conditioning: 0–no; 1–yes.
15. X_{15} = Exterior: 1–framed; 2–brick 50% and wood 50%; 3–brick at least 75% and remainder wood; 4–brick veneer; 5–stone veneer.
16. X_{16} = Shape of lot: 1–regular; 2–irregular.
17. X_{17} = Separate garage: 1–yes; 2–no.
18. X_{18} = Porch: 0, 1, 2, 3, etc.
19. X_{19} = Terraces: 0, 1, 2, 3.
20. X_{20} = Type of terrace: 0–no terrace; 1–concrete; 2–brick.
21. X_{21} = Size of terrace in square feet.
22. X_{22} = Subdivision: 1–Lansdowne; 2–Gainesway; 3–Stonewall; 4–Twin Oaks-Garden Springs; 5–Deep Springs; 6–Southland; 7–Zandale.
23. X_{23} = Location in Lexington: 1–Southeast; 2–Southwest; 3–Northeast.
24. X_{24} = First sale: 1–yes; 2–no.
25. X_{25} = Porch type for first porch: 0–no porch; 1–main roof; 2–own roof; 3–enclosed.

26. X_{26} = Porch type for second porch: 0–no porch; 1–main roof; 2–own roof; 3–enclosed.
27. X_{27} = Total porch(s) size in square feet.
28. X_{28} = Foundation: 1–concrete block; 2–solid masonry.
29. X_{29} = Floors: 1–hardwood; 2–concrete.
30. X_{30} = Fireplace: 1, 2, 3, etc.
31. X_{31} = Interior: 1–dry wall; 2–plaster.
32. X_{32} = Roof: 1–flat; 2–hip; 3–gable.
33. X_{33} = Tax and school district: 1–city government and county school; 2–county.
34. X_{34} = Front footage of lot.
35. X_{35} = Type of lot: 1–regular; 2–corner; 3–cul de sac.

The reader should keep in mind the purpose of his model is to test the feasibility of the concept and to determine what variables should be included in an actual working model.

The Regression Model

The model used in the analysis was the following:

$$Y \text{ (the value of the single family residence)} = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + b_{14}X_{14} + b_{15}X_{15} + b_{16}X_{16} + b_{17}X_{17} + b_{18}X_{18} + b_{19}X_{19} + b_{20}X_{20} + b_{21}X_{21} + b_{22}X_{22} + b_{23}X_{23} + b_{24}X_{24} + b_{25}X_{25} + b_{26}X_{26} + b_{27}X_{27} + b_{28}X_{28} + b_{29}X_{29} + b_{30}X_{30} + b_{31}X_{31} + b_{32}X_{32} + b_{33}X_{33} + b_{34}X_{34} + b_{35}X_{35}.$$

Using this basic model, the computer analyzed all the data on the 575 individual property sales and produced the following "b" values:

Variable	*Coefficient*
a –constant	$4,448.24
b_1–area	6.73
b_2–age	64.24
b_3–lot size	0.09
b_4–rooms	324.79
b_5–stories	-384.60
b_6–basement	165.05
b_7–finished basement	2,152.87
b_8–amount of basement finished	286.68
b_9–half-story	-384.34
b_{10}–bathrooms	360.19
b_{11}–toilet rooms	572.23
b_{12}–single fixtures	-173.66

b_{13}–heating	52.25
b_{14}–air conditioning	1,932.04
b_{15}–exterior walls	433.09
b_{16}–lot shape	80.82
b_{17}–separate garage	-586.79
b_{18}–porch	-355.21
b_{19}–terrace	-780.58
b_{20}–type terrace	334.72
b_{21}–terrace area	2.72
b_{22}–subdivision	2.62
b_{23}–area of Lexington	-296.55
b_{24}–times sold	-576.65
b_{25}–description of porch 1	-239.64
b_{26}–description of porch 2	-295.85
b_{27}–porch size	7.91
b_{28}–foundation	392.02
b_{29}–floors	-282.52
b_{30}–fireplaces	838.32
b_{31}–interior	979.56
b_{32}–roof	40.89
b_{33}–tax and school district	-694.06
b_{34}–front footage	0.05
b_{35}–lot type	51.07

Table XIX shows which of these 35 variables were significant and at what level they were significant.

When these coefficients were placed in the regression model, a value-predicting–an assessing–model was produced. This assessing model was used to predict the values of the properties sold in the 575 transactions. The standard error of Y, the predicted property value, was $2,861.06. The R^2 was .8256. Therefore, the model explained 82.56 percent of the variation in the actual sale prices.

Analyzing the Results of the Assessing Model's Evaluations

Since the original purpose of the assessing model was to provide an improved method of mass appraisal, the best way to evaluate the model appeared to be to compare its assessments to the assessments produced by the 1965 revaluation.

The model's predictions were considered the assessed values of the properties. These assessments were compared to the actual sales prices to produce assessment-sales ratios. The individual assessment-sales ratios were grouped according to the property's location. The reader will remember that these property transactions were chosen in such a manner that they would provide representative samples of properties in seven areas of Lexington. The analysis of the effects of the full-value assessments had also included seven areas. Thus, two sets of samples drawn from the same

TABLE XIX

THE LEVELS OF SIGNIFICANCE IN VARIABLE COEFFICIENTS IN THE ORIGINAL ASSESSING MODEL

Variable	Value	Significance Level		
		99%	95%	90%
1. Area (b_1)	14.25	Yes	Yes	Yes
2. Age (b_2)	0.94	No	No	No
3. Lot size (b_3)	3.15	Yes	Yes	Yes
4. Rooms (b_4)	1.78	No	No	Yes
5. Stories (b_5)	-1.85	No	No	Yes
6. Basement (b_6)	0.38	No	No	No
7. Finished basement (b_7)	2.64	Yes	Yes	Yes
8. Amount of basement finished (b_8)	0.86	No	No	No
9. Half story (b_9)	-1.41	No	No	Yes
10. Bathrooms (b_{10})	4.30	Yes	Yes	Yes
11. Toilet rooms (b_{11})	1.96	No	Yes	Yes
12. Single fixtures (b_{12})	-0.18	No	No	No
13. Heating (b_{13})	1.16	No	No	No
14. Air conditioning (b_{14})	2.69	Yes	Yes	Yes
15. Exterior walls (b_{15})	1.92	No	No	Yes
16. Lot shape (b_{16})	0.28	No	No	No
17. Separate garage (b_{17})	-1.18	No	No	No
18. Porch (b_{18})	-0.57	No	No	No
19. Terrace (b_{19})	-1.18	No	No	No
20. Type of terrace (b_{20})	0.65	No	No	No
21. Terrace area (b_{21})	1.27	No	No	No
22. Subdivision (b_{22})	0.85	No	No	No
23. Area of Lexington (b_{23})	1.42	No	No	No
24. Times sold (b_{24})	1.57	No	No	No
25. Description of porch 1 (b_{25})	0.76	No	No	No
26. Description of porch 2 (b_{26})	-0.59	No	No	No
27. Porch size (b_{27})	4.34	Yes	Yes	Yes
28. Foundation (b_{28})	0.69	No	No	No
29. Floors (b_{29})	-0.47	No	No	No
30. Fireplace (b_{30})	3.95	Yes	Yes	Yes
31. Interior (b_{31})	2.25	No	Yes	Yes
32. Roof (b_{32})	0.13	No	No	No
33. Tax and social district (b_{33})	2.02	No	Yes	Yes
34. Front footage (b_{34})	0.02	No	No	No
35. Lot type (b_{35})	0.20	No	No	No

seven areas existed. One set was a representative sample of the assessment-sales ratios produced by the assessing methods used in the full-value assess-

TABLE XX

ORIGINAL MODEL ASSESSMENTS VS. REVALUATION ASSESSMENTS

Research Areas	Model		Revaluation	
	A/S	Coefficient of Variation	A/S	Coefficient of Variation
II-C-2 Deep Springs	100.22	11.40	98.12	16.52
II-C-4 Garden Springs	99.40	11.50	90.17	8.31
III-C-4 Lansdowne	99.97	13.14	94.13	12.46
III-C-2 Stonewall	103.38	13.23	86.36	14.58
III-C-3 Gainesway	106.05	10.71	96.54	11.39
II-B-5 Southland	101.75	9.04	87.77	13.71
III-B-1 Zandale	100.23	10.63	89.99	13.99
Overall	101.18	11.79	91.68	13.81

ment. The second set was a representative sample of the assessment-sales ratios produced by the regression model. Both assessments were for the same areas. Only the method of assessing was different. All that was needed to compare the two different assessing techniques was to compare the assessment-sales data in the two samples.

The coefficient of variation was chosen as the best statistic to use in the comparison. It shows the degree of equity attained by the assessment—and the greatest source of public dissatisfaction with the tax commissioner is the inequities in assessments.

A "T" test was used to measure the significance of the difference between the coefficient of variation of the assessments for each study area. (No attempt was made to test the significance of the difference between the average assessment-sales ratios.) The table above (Table XX) shows the results of the comparison of the two methods of mass appraisal. The "T" test showed a significant difference at the 99% confidence level for the variation obtained in three areas, II-C-2 (Deep Springs), II-C-4 (Garden Springs), II-B-5 (Southland), and for the overall variation. (No additional differences were identified as significant by application of the 95% con-

TABLE XXI

TEST FOR THE SIGNIFICANT DIFFERENCE BETWEEN THE MODEL-OBTAINED VARIATION AND THE VARIATION IN THE REVALUATION ASSESSMENTS

Research Areas	T	Significance 95 Percent	Significance 99 Percent
II-C-2	2.36	Yes	Yes
II-C-4	2.51	Yes	Yes
III-C-4	0.37	No	No
III-C-2	0.68	No	No
III-C-3	0.38	No	No
II-B-5	2.51	Yes	Yes
III-B-1	1.71	No	No
Model vs. Revaluation	2.84	Yes	Yes

fidence-level standard.) Among the areas where there was a significant difference between the level of variation obtained by the model assessment and by the revaluation, only one had a smaller coefficient of variation than that for the revaluation assessment. In the other areas, the model gave significantly less variation in its assessments. For the overall variation, again the model yielded assessments that had significantly less variation in them than those obtained in the revaluation. This last significant difference is the most important, for it shows that the model approach was able to produce more equitable assessments for the overall assessment than the revaluation had produced.

Improving the Original Assessing Model and an Improved or Practical Assessing Model

As has been repeatedly emphasized, not only must the model be accurate it must also be relatively easy and inexpensive to use. For this reason several attempts were made to simplify the model as well as increase its accuracy. Attempts at fitting curvilinear functions to the area of the house, number of stories, lot size, and subdivision variables did not improve the predictability of the model. Another approach tried was to develop a separate model for each subdivision. The reduction of the sample and population variability by subdividing the original sample increased the assessment accuracy obtained by each new model, but this approach was ruled out. Table XXII shows the comparison of the results obtained by the subdivision assessing model and the revaluation assessments. For use in an actual assessment, a different model developed for each subdivision

TABLE XXII

SUBDIVISION MODEL ASSESSMENTS VS. REVALUATION ASSESSMENTS

Research Areas	Area Analysis		Revaluation Results	
	A/S	Coefficient of Variation	A/S	Coefficient of Variation
II-C-2 Deep Springs	100.93	10.26	98.12	16.52
II-C-4 Garden Springs	100.54	10.56	90.17	8.31
III-C-4 Lansdowne	101.50	13.44	94.13	12.46
III-C-2 Stonewall	101.42	12.55	86.36	14.58
III-C-3 Gainesway	100.52	7.78	96.54	11.39
II-B-5 Southland	100.60	7.35	87.77	13.71
III-B-1 Zandale	104.31	9.01	89.99	13.99

would require more work and expense that its additional accuracy would warrant. However, beneficial results, without excessive additional expenses, might be obtained if the residential population of a city were stratified into a few general categories and different models developed for each category.

The final decision on a model was to use the original model form but to reduce the number of variables, thereby simplifying the model. Also, since fewer data would be needed for the model assessment, the labor and expense involved would be reduced. The criterion used to select which variables to include in the model was the variable's ability to add to the predictability of the model, as measured by its effect on the R^2 of the model. Thirteen variables were selected. Additional variables did not appreciably raise the R^2 of the model and only added to the complexity of the model. The fewer the number of variables the less time and expense involved in compiling the data and making the assessment. The thirteen variables chosen were:

X_1 = area in house
X_2 = size of lot
X_3 = stories

X_4 = finished basement
X_5 = bathroom
X_6 = toilet rooms
X_7 = air conditioning
X_8 = exterior
X_9 = subdivision
X_{10} = porch size
X_{11} = fireplace
X_{12} = interior
X_{13} = tax and school district

The coding used on these variables was the same as that used for the original model. The new model derived was:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13}.$$

Solving for the "b" values, the following results were obtained:

Variable	*Coefficient*
a (constant)	$3,545.81
b_1 (area of house)	7.30
b_2 (lot size)	0.10
b_3 (stories)	-288.58
b_4 (finished basement)	2,220.98
b_5 (bathroom)	340.66
b_6 (toilet rooms)	2,048.11
b_7 (air conditioning)	464.26
b_8 (exterior)	-560.53
b_9 (subdivision)	-29.40
b_{10} (porch size)	7.67
b_{11} (fireplace)	858.90
b_{12} (interior)	1,231.71
b_{13} (tax and school district)	-718.34

The following table (Table XXIII) shows which of these 13 variables were significant and at what level they were significant. The standard error of Y, the predicted property value, was $2,867.65. The R^2 was 0.8143.

Comparing the Assessments Obtained by the Practical Assessing Model to the Assessments Obtained by the Revaluation Methods

A slightly different approach was taken to compare the assessments produced by this "practical" model to the assessments produced by the revaluation methods. The regression model just described used 1965 market data to obtain the coefficients used in the model to evaluate properties sold

TABLE XXIII

THE LEVELS OF SIGNIFICANCE IN VARIABLE COEFFICIENTS USED IN THE PRACTICAL ASSESSING MODEL

Variable	T Value	Significance Level		
		99%	95%	90%
b_1 Area of house	17.95	Yes	Yes	Yes
b_2 Lot size	3.86	Yes	Yes	Yes
b_3 Stories	11.51	No	No	No
b_4 Finished basement	9.85	Yes	Yes	Yes
b_5 Bathroom	4.63	Yes	Yes	Yes
b_6 Toilet rooms	2.92	Yes	Yes	Yes
b_7 Air conditioning	2.13	No	Yes	Yes
b_8 Exterior	-1.64	No	No	Yes
b_9 Subdivision	-0.37	No	No	No
b_{10} Porch size	4.65	Yes	Yes	Yes
b_{11} Fireplace	4.20	Yes	Yes	Yes
b_{12} Interior	3.46	Yes	Yes	Yes
b_{13} Tax and school district	-2.31	No	Yes	Yes

in 1965. These model assessments were compared to their respective 1965 sales values to obtain the assessments-sales ratio data used in comparing the model assessments to the revaluation assessments. The revaluation, on the other hand, had used sales data from late 1965 to provide assessments for 1966 and 1967. These assessments, based on 1965 sales, were compared to the actual sale prices for 1966 and 1967 to obtain the revaluation assessment-sales ratios. One might raise a question about the fairness of comparing the model assessment data to the revaluation assessment data because of this slight difference in the data base. Thus, to further verify the effectiveness of a regression model appraisal, the same properties used to determine the effects of the full-value assessment for 1966 and 1967 were assessed by this "practical assessing" model. The samples of two areas were used for this comparison.

The model was used to assess the values of the sample sales in the Deep Springs (II-C-2) and Gainesway (III-C-3) areas. These assessed values were compared against the sale values by the assessment-sales ratio approach. The average assessment-sales ratio and the coefficient of variation were calculated for each area. These values were then compared to those

TABLE XXIV

PRACTICAL MODEL ASSESSMENTS VS. REVALUATION ASSESSMENTS

Research Areas	Model Results		Revaluation Results	
	A/S	Coefficient of Variation	A/S	Coefficient of Variation
II-C-2 Deep prings	101.69	11.95	98.12	16.52
III-C-3 Gainesway	102.01	10.26	96.54	11.39

obtained by the full-value assessment. Since the observations used were the same in both samples, the results obtained by the two methods can be directly compared. Again, the only valid comparison that can be made is between the coefficients of variation (Table XXIV). One can see that the coefficient of variation obtained by the model is lower than that obtained by the revaluation for both the Deep Springs area and the Gainesway subdivisions. Thus, the model obtained a greater degree of equity than the methods used in the revaluation.

The assessment-sales ratios obtained by the model were also closer to 100 percent than those obtained by the revaluation. The model assessment-sales ratios would, of course, be lowered as persons with assessments greater than the market value of their property had their assessments lowered.

The results obtained from the practical assessing model were more accurate than those obtained by the full-value assessment. The comparison tables point out this fact. The model results have not been subjected to the lowering effect of the reductions granted for over-assessed properties. Lowering effects, such as those to which the revaluation results were subjected, would reduce the average assessment-sales ratio obtained by the model, causing it to fall more nearly in line with the revaluation average ratio of 91.57% previously mentioned. Such a lowering effect would also reduce the variability obtained by the model, causing its coefficient of variation to be reduced to an even lower level, a level significantly lower than the coefficient of variation obtained by the revaluation. Furthermore, the full-valuation results had had the benefit of a review by professional assessors who spotted gross assessment errors and corrected them. The model results were not subjected to such review. Had the results been checked by professional assessors, definitely, the glaring errors would have been caught and corrected. Any such corrections would have improved the accuracy and equity obtained. In actual use, model results would be subjected to a correcting review. In light of these advantages that the revaluation results had over the model results, the fact that the model gave assessments that were more accurate and equitable than the revaluation assess-

ments is strong evidence of the superiority of a regression-analysis approach to the assessment of residential property.

Further Improvements and Research Needed in Developing the Regression Model Approach to Mass Assessments

The argument can be made even more convincing when one considers the possible improvements that can be made in the model approach. Although the results of these first experimental models not only proved the usefulness of a regression approach but were in themselves gratifying, future models could be greatly improved—as the "practical" model was an improvement over the first regression model. There is no doubt that greater accuracy, equity, and efficiency can be obtained through further efforts. Several variables on which data were not readily available should be explored. One must remember, however, that these variables must be of such nature that the necessary data could be obtained without undue expense and effort on the part of the tax commissioner's staff. Probably the most important variable that could reasonably be included would be a factor that would take into account the terms of financing the sale, particularly during times of tight money. Residences with low-interest sale mortgages, and residences whose financing can be easily transferred without large cash outlays, are selling at large premiums. The present model does not fully consider these factors. A quality factor would also enhance the predictability of the model. Although a quality rating for each residence would be desirable, such a factor would not be practical. A quality rating for each residence would have to be obtained. Furthermore, since the general conditions of a residence can change in a short period, especially in the period prior to a sale, this factor would have to be continually checked and updated. The cost and expense involved would likely outweigh the advantages gained. A factor that took into account the landscaping of the residence would obtain some of the quality considerations and yet probably be more stable.

Beneficial results, without excessive additional expense, might be obtained if the residential population of a city were stratified into a few subgroups and different models developed for each group. The groupings should be kept on a general basis. They should not be reduced to such narrow categories as subdivisions. Different models were not used in the regression model analysis because the properties used to develop the regression model were a fairly homogeneous group. For a city-wide appraisal, however, models could be developed for different categories based on locational, value, age, or other differences.

Improvements could also be made in the quality of the data used in the model construction and analysis. The data used were obtained for the purpose of assessing by the reproduction-cost-assessment method. Such data are not the best for a regression analysis. For example, square-footage statistics included enclosed and finished garages. A regression model would

likely predict more accurately if the square footage of living area were used and a separate factor used for garages. The model uses the data in a different manner and is based on a different approach to assessing; therefore the data needed for the model are different from the data needed for present assessment purposes. A switch to the model approach to assessing would, over time, require certain changes in data obtained by the commissioner's staff. These changes would not have to be very drastic and would probably alter the present procedures of data-collection only slightly. If anything, the smaller number of variables needed for the model would reduce the amount of data needed on each residence and thereby reduce the effort and expense involved in data-collection.

Finally, further analysis needs to be made of the instances where the model assessed very accurately and very inaccurately. Such analysis would provide clues for improving the model. Analysis of these assessments with their corresponding property characteristics has revealed nothing of significance. However, further analysis might prove beneficial. There is no definite relationship between the degree of accuracy and over, or under, assessments. For the highly accurate assessments (accuracy meaning assessment being within $100 of the market value), 21 were under-assessed and 10 were over-assessed. For the highly inaccurate assessments (failed to be within $5,000 of the market value), 18 assessments were under market value and 15 assessments were over market value. There was some correlation between subdivision and accuracy. The subdivisions with larger, more expensive, and heterogeneous homes had the larger percentage of highly inaccurate assessments, while the subdivisions with smaller, less expensive, more homogeneous homes had the larger percentages of highly accurate assessments. There is a definite inverse correlation between the value of the residence and the accuracy of the assessment. The average value for properties that were accurately assessed was $19,255.34 while the average value for properties that were very inaccurately assessed was $28,180.94. There was also some correlation between lot type and accuracy of assessment. Although there was no difference in accuracy of assessment for corner or standard lots, four residences on *cul de sac* lots were poorly assessed while no residences on *cul de sac* lots were accurately assessed. From these findings one could generalize about the results obtained from the model and conclude that model is more likely to be most accurate in assessing smaller, less expensive, more uniform properties and less accurate on larger, more expensive, more heterogeneous residences. In either case, it is more likely to be more accurate, more equitable, more efficient, more easily updated, and more procedurally uniform than currently employed techniques.

Conclusions

In conclusion, the researchers feel that they have accomplished their objective—to develop and illustrate a feasible alternative approach to the assessment of urban residential property. The study demonstrated how

to construct a model which can accurately assess residential properties. This model was tested and showed highly satisfactory and encouraging results. The researchers pointed out areas for further improvements in the model which could provide an improved assessment for urban residential properties and improved assessing procedures (both from an economic and administrative viewpoint). Therefore, in response to the concluding questions reached in the analysis of the effects of the full-assessment, no longer is the present status of residential assessing in Kentucky as good as can be expected. A good job has been done, but now an even better job can be done.

The rapidly-growing demands on state and local government has created an urgent need for increased revenues at the state and local level. In search of these funds officials have naturally focused attention on property taxes, a proven revenue producer. However, if property taxes are to continue as an important source of revenue, improvements must continue in the property taxation system. The method proposed in this study could make substantial improvements in the assessment of residential properties for taxing purposes.

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